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BUREAU OF PUBLIC RELATIONS

DENTAL ECONOMICS

COUNCIL ON DENTAL THERAPEUTICS

FIFTY CENTS

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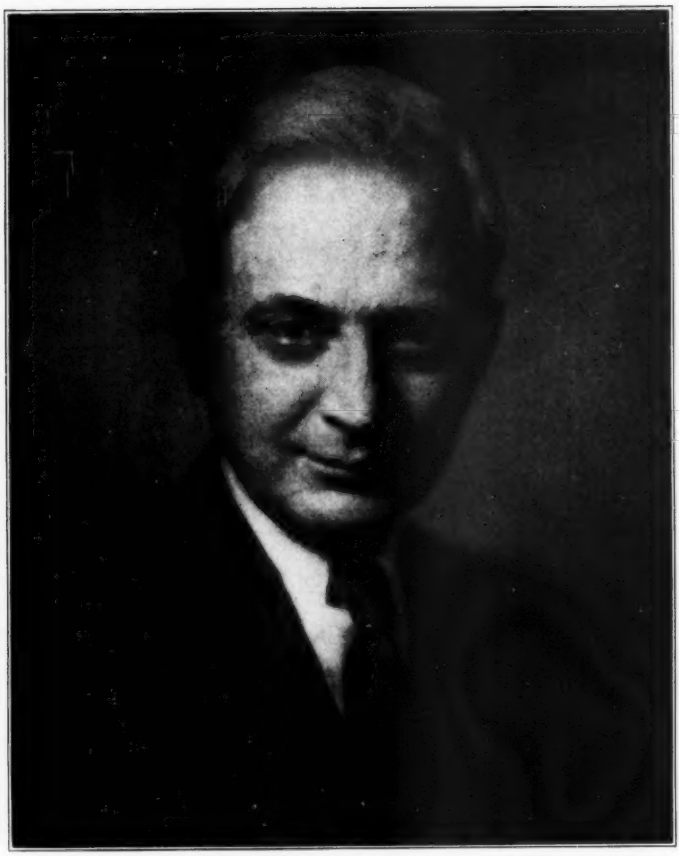

T. A. HARDGROVE, D.D.S., Fond du Lac, Wis.
Vice President of the American Dental Association

THE JOURNAL *of the*
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Vol. 24 NOVEMBER 1937 No. 11

STRUCTURAL CHANGES IN PERIAPICAL AND OTHER ORAL INFECTIOUS PROCESSES AND THEIR SIGNIFICANCE

By EDWARD H. HATTON, B.L., M.D., Chicago, Ill.

INTRODUCTION

THE cellular structure in infectious processes has been under rather constant scrutiny ever since the introduction of the compound microscope and the more refined histologic methods. The relationship of the progressive tissue changes of the hosts to the life phases of the invading microorganisms has received too little consideration, on the one hand and, on the other, the little that is known has been overshadowed by acrimonious discussion based on conflicting experimental data.

Only concerning such processes as tuberculosis have studies been made that are rather inclusive. In this disease, the situation is complicated, and there is a definite possibility that the process may be different from that in the majority of other infections. On the other hand, many phases of the mechanism of the disease have been very carefully studied. The infection develops slowly and, in this slow progression, there is abundant opportunity for the formation of rather permanent tissue records of the steps in the progression. It is known, for example, that the initial invasion differs from all subsequent ones, so much so that, in the lung, the first lesion is given a specific name and its characteristics are quite well understood. In this disease, live bacteria excite a different type of reaction from dead bacteria. The waxy material of the capsule acts differently from the proteins, and the types of these reactions have been studied and are known. The important matter is that the live organisms, the dead bodies of tubercle bacilli, the lipoid substance and the tuberculous proteins do call forth reactions of the cells and tissues of the host. These reactions, in addition, are highly characteristic and reflect in a most delicate fashion all of the factors pertaining both to host and to parasite and entering into the conditioning of the process in each individual case. Because

(Read before the Section on Therapeutics, Pathology and Research at the Seventy-Third Annual Midwinter Clinic of the Chicago Dental Society, February 17, 1937.)

of this and other examples, it is easy to believe that the tissues react in characteristic ways to invasion by bacteria and to the presence of their products. On the other hand, it is very difficult to believe that they do not react at all to the presence of disease-producing bacteria in their midst.

EVIDENCE OF INFECTION

This introduction may supply a sufficient excuse to discuss two matters which of themselves are not definitely related to each other. One of them has to do with a growing tendency to accept as conclusive evidence of the presence of an infectious process the demonstration of bacteria in these tissues or organs by cultural or staining methods. Even in the absence of either microscopic or gross changes in such organs and tissues, this disclosure of bacteria is considered to be final. The second matter has to do with changes that take place in reactions to the presence of bacteria about teeth after the migration of epithelium to or the hyperplasia of epithelium in these regions. Since these observations deal with bacteria and infection, this association is not so far-fetched.

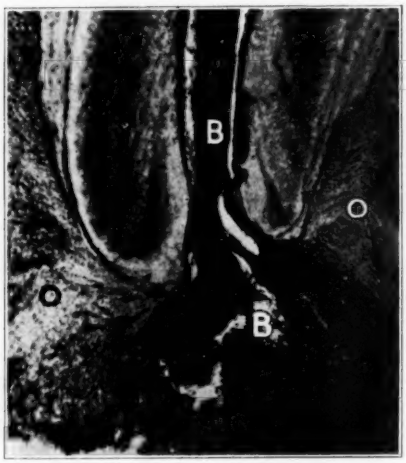

Fig. 1.—First of a series of periapical infections; showing probable distribution of bacteria in places marked B and absence of bacteria in regions marked O. This is a very recent type of infection without much detachment of the peridental membrane.

In other papers read before this section, the matter of the interpretation of cultures made from extracted teeth has been discussed at considerable length. In line with the preceding discussion, it should be said that too much attention has been paid to the bacteria obtained by such experiments and too little to the tissue changes involved in the regions under study.

For instance, the situation has been discussed recently somewhat as follows: If the apical regions of extracted teeth, together with the tissues that may have remained attached to the teeth in the extraction, be incubated for short periods in suitable culture media after the extraction, bacteria may be demonstrated in these tissues. If bacteria are disclosed by suitable histologic and staining technic in this fashion, it is rather conclusive evidence that these tissues are infected regardless of the histologic picture, though perhaps not wholly regardless of the histologic picture, because the more nearly normal the picture, the more hazardous the situation. In such preparations, bacteria have been demonstrated within a

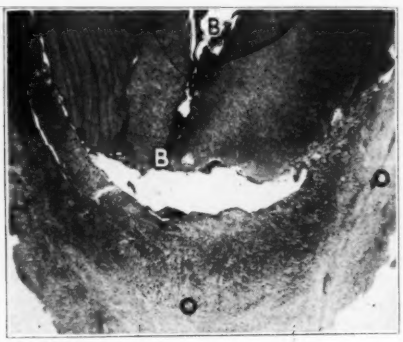

Fig. 2.—Very old periapical infection with marked detachment of peridental membrane. B, bacteria present. O, bacteria absent.

few cell layers of the surface of the alveolar process, only one, two or more cells away from the bone, but equally close to the torn margin. Similar cocci are demonstrated by these methods in regions in which there is a complete absence of tissue reaction, but, generally speaking, close to the periphery of the granuloma extracted with the tooth. On the other hand, such cocci are absent or not conspicuous in infiltrated regions or in necrotic masses. From this and similar discussions, one might well conclude that the one characteristic condition favoring bacterial invasion of a hazardous type is absence of tissue reaction plus the recovery

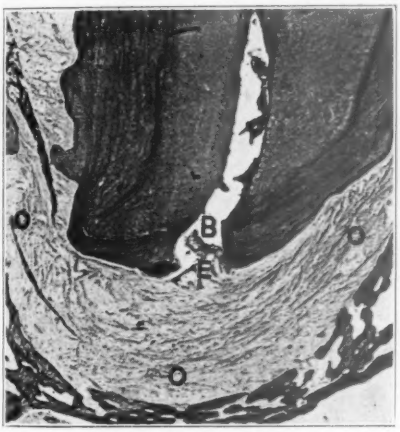

Fig. 3.—Old fibrous periapical process, with just a suggestion of epithelial proliferation at E. B, bacteria present. O, bacteria absent.

of bacteria by cultural methods or their demonstration by staining the sectioned tissues.

It is refreshing indeed to contrast this discussion with the work of Fish and Maclean which was published in the September 15, 1936, number of the *British Dental Journal*. In particular, the attempt of these authors to rationalize the biologic implications of their experiments should be praised. They have constructed for the case of the chronic oral infections caused by streptococci a very satisfying concept, useful to both the clinician and the investigator. It is useful to the clinician for it supplies him with a yardstick by which he may measure quite accurately the extent of streptococcal penetration and the nature of tissue damage as depicted by the x-rays. It is useful to the bacteriologist and pathologist because it considers the nature of the streptococcal invasion from the biologic point of view. These authors argue that, in chronic proc-

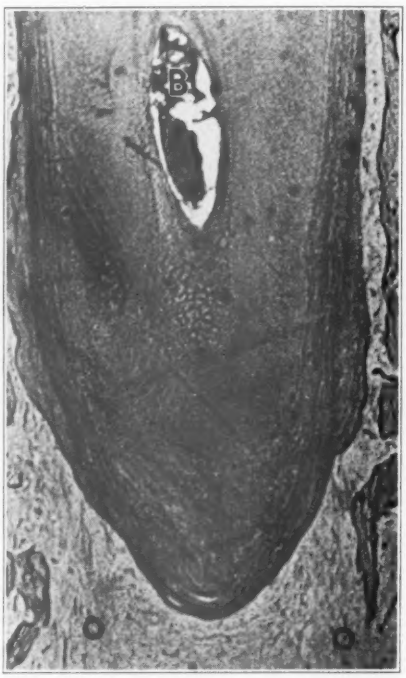

Fig. 4.—Old periapical infection with gangrenous pulp. There is no detachment of peridental membrane and no infiltration in the fibrous granuloma. B, bacteria present. O, bacteria absent.

esses, the streptococci are limited in their distribution, except momentarily, to foci of necrotic protoplasm and that they cannot exist for long among normal living cells.

This may be restated by saying that the streptococci are never persistent inhab-

itants of living tissues, but always require necrotic and inert débris in which to grow and to persist. According to them, the round-cell infiltration frequently encountered in these reactions is a response to toxic products emanating from streptococci sheltered in these masses of dead protoplasm. Resorption of bone or bone sclerosis is produced by such toxic substances and not by the actual presence of the streptococci in the bone. The absence of such inflammatory infiltrations and of bone changes is to be interpreted as significant of the absence of organisms

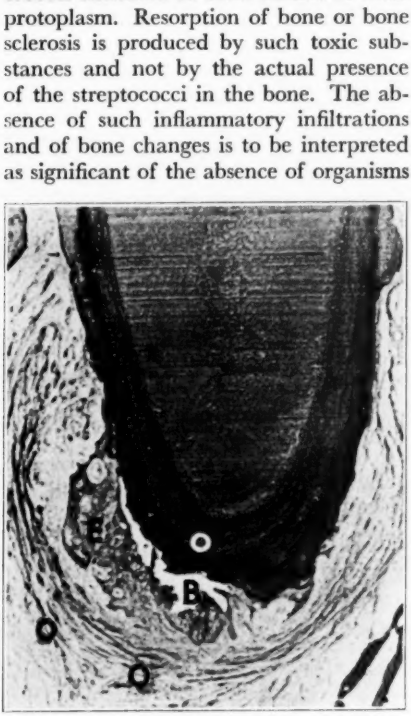

Fig. 5.—Old periapical infection, fibrous type, with beginning epithelial proliferation; the first stage of formation of a cyst. There is a strong probability of the presence of bacteria at B. Elsewhere, as at O, etc., bacteria are absent.

or toxic substances, or indeed the absence of both bacteria and irritating organic compounds, at least those from disease-causing germs. In other words, if a pulpless tooth is without any changes to be noted by the x-rays either in the tooth or in the bone, provided the pictures cover enough ground, there is little probability of an infectious process being present.

They have also studied the behavior of teeth in the tooth socket during forceps extraction with reference to the possibility of aspiration of organisms from the gingival crevice into the socket. You are referred to this very excellent article for a detailed account of their experiments in this part of their investigation. These experiments seem to have been adequately controlled and carefully performed. According to the authors, organisms reach the apical region, the pulps and even the

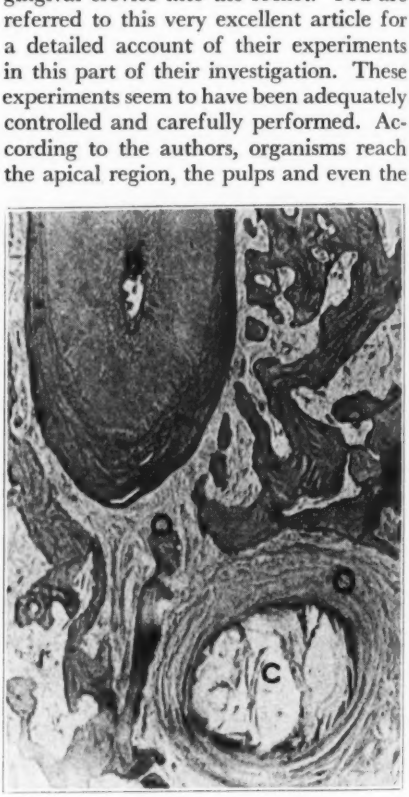

Fig. 6.—Fully developed dental root cyst, with cavity completely cut off from the root canal, at least at this level. B, bacteria present. O, bacteria absent. C, cyst cavity.

blood vessels during the course of a forceps extraction. They believe that the bacteria are pumped into these different places by manipulation of the teeth during the act of extracting by the forceps method.

PERIAPICAL INFLAMMATIONS

These observations and conclusions are in harmony with the data already men-

tioned, which some of us have presented to this society at former sessions. We have shown that cultures from the scrapings from the roots of teeth extracted by forceps are almost uniformly positive. This is also true of cultures made from the blood aspirated from the socket immediately after the tooth is extracted. The number of the bacteria recovered in this way is dependent largely on the degree of infestation of the gingival crevice and the amount of manipulation of the tooth required to dislodge it from the socket. We and others have shown that the only simulation of a correlation between bacteriologic findings and those implied by the study of roentgenograms is found in the cases studied by methods which include some adequate control of the material used for culture, as by sterilizing the outside of the root before scrapings are removed for cultural purposes. In other words, all suspicion of contamination must be eliminated before the data can be studied at all.

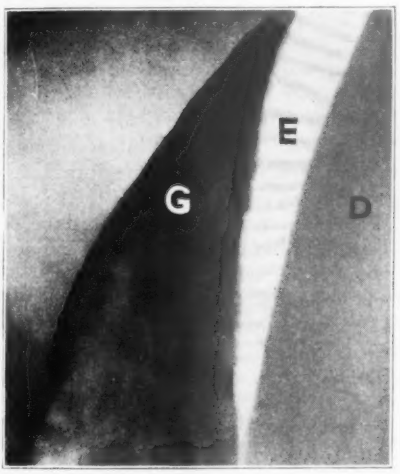

Fig. 7.—Longitudinal labiolingual surface of section through incisor and attached gingiva of young dog. There is no subgingival space. G, gingiva. E, enamel. D, dentin.

Material of another source which tends to verify this position has to do with sections made from extracted teeth used for various purposes. This is especially true in those instances wherein it is known that careful preparation of the field from the aseptic point of view has not been made, and also in those instances in which it was known that the gingival crevice was teeming with bacteria at the time of extraction. If these sections are stained for bacteria, and often when routine staining methods are used, organisms are found in the margins of peridental tissue torn off with the tooth. The position, of course, is adjacent to the outside surface, just in the same position for which such great significance has been claimed by those who emphasize the importance of the mere presence of bacteria in tissues as conclusive proof of infection. These observations are not limited to our experience, but have been noted by others.

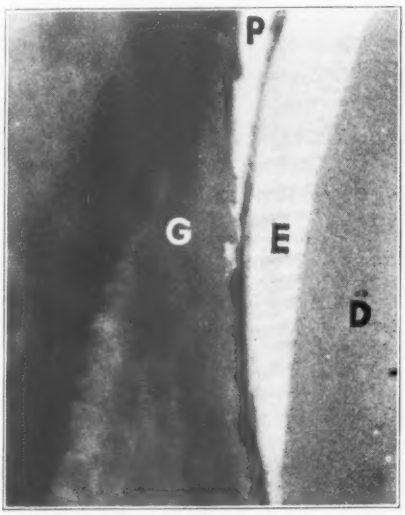

Fig. 8.—Section shown in Figure 7, illustrating separation of gingiva from enamel without force by a pointed probe. As soon as the probe is withdrawn, the position shown in Figure 7 is resumed. G, gingiva. P, probe. E, enamel. D, dentin.

The point of view based on these ob-

served facts tends to eliminate the contradictions and incongruities (and here I use the word "incongruity," also chosen by Fish and Maclean) between the conclusions arrived at on the basis of the examination of these oral structures by bacteriologic, roentgenographic, histologic and clinical methods. The only conclusion that would seem at all tenable is that unless some way can be found to completely eliminate all suspicion of contamination in the culture of extracted teeth, bacteriologic examination of extracted

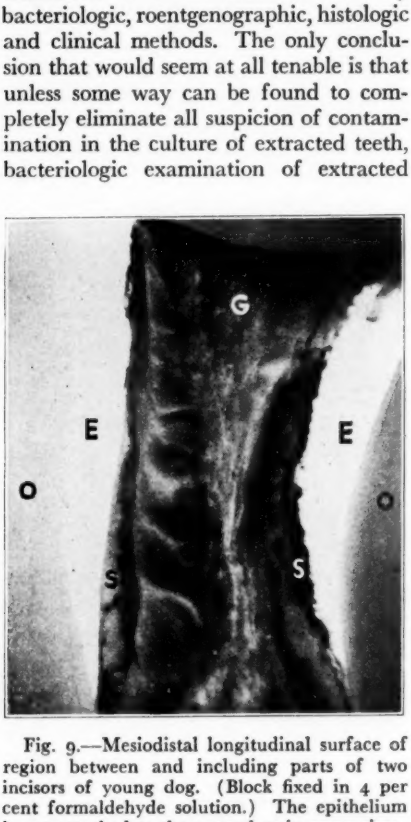

Fig. 9.—Mesiodistal longitudinal surface of region between and including parts of two incisors of young dog. (Block fixed in 4 per cent formaldehyde solution.) The epithelium is not attached to the enamel or in approximation, except at the gingival crest, because of the shrinkage from fixation or postmortem contraction. S, space containing white flaky, soft débris. O, dentin. E, enamel. G, gingiva.

teeth should be completely abandoned. This includes cultures for diagnostic purposes, cultures to obtain material for the preparation of autogenous vaccines and cultures made in the course of research.

It does seem that the approach to the apical region through an incision into and through the gingiva and the alveolar process has not been sufficiently explored. I regret that I am not able to submit some figures with respect to this method of obtaining material for bacteriologic examination, as was my intention at the time this paper was first planned. Cultures may be made without extraction, and always before extraction. Indeed, extraction may be indefinitely postponed. The operation involves the surgical exposure of the apex through the buccal or labial surfaces, except in lingual roots. On exposure of the bone, the wound should be re-treated with suitable germicidal drugs, or in some other way to insure sterility, and a new set of instruments should be used to replace those employed in the stages up to this point in the procedure.

Further studies of the tissue changes in chronic oral streptococcic infections must be made with reference to the distribution and effect of the bacteria and their products in lesions of the type of those of Fish and Maclean. Certainly, sweeping deductions based on the demonstration of bacteria in extracted teeth, and in the face of a conspicuous absence of inflammatory tissue changes, are not, in all cases, warranted or are almost not warranted, since the deduction that such teeth are wholly harmless might have a measure of justification.

GINGIVAL INFLAMMATIONS

In the study of specimens made by grinding whole frozen blocks of tissue, it has been found that the mechanical attachment of the epithelium to the enamel is very slight, indeed so slight as to be of little significance from the standpoint of withstanding mechanical trauma. It is only the elasticity of the gingival fibers that holds the gingiva in close approximation to the enamel. On the other hand, fluids do not pass into the region between the gingiva and the enamel with any greater ease than by diffusion. In other words, dyes, suspensions, etc., seem

to reach the enamel surface quite as readily through the gingival tissues as along the enamel surface. This, of course, opens up a very interesting problem for investigation. Long before the idea of an epithelial attachment was conceived, it was known that the enamel surface in contact with the gingiva behaved quite differently from the enamel surface fully exposed in the mouth, and yet adjacent to the first mentioned surface. For example, gingival third caries is sharply limited to surfaces not covered by intact gingiva.

In connection with the combination of circumstances described in the preceding paragraph, one is reminded of the very interesting situation found in many instances of hyperplastic pulps. In these, if the crowns are completely lost by caries, the robust, vascular granulation tissue, mushroom-like, spreads out over the root of the tooth. Usually, the outer surface of this polypoid mass acquires an epithelial covering by extension or transplant from adjacent mucous membranes. The important matter is that the shelf of dentin covered by this mass is no longer susceptible to caries, the process of decay is arrested and the dentin becomes firm and eburnated. In sections made at such junctions, there is found not only an absence of caries of the dentin, but also some degree of attachment of the surface covered with epithelium to the dentin. This attachment or relationship is of no mechanical significance, but, what is more important, dental caries becomes inactive beneath it. Neither does caries extend beneath the epithelial attachment of the gingivae.

Another analogy is to be found in the transition of a periapical infection to a radicular cyst, by the replacement of the granulation tissue in this region by a cavity surrounded by a sac made up of connective tissue lined with epithelium. In the transition of the periapical infectious process to a cyst, the contents of the cyst cavity become sterile. In many instances, it has been demonstrated that in the development of the condition out of the granulation tissue, the epithelium proliferates close to denuded tissues at the apex of the tooth. Again, an epithelial relationship is formed, call it attachment or what you will, to the border of the denuded surface of the tooth apex and adjacent to the firm attachment of the peridental membrane to cementum. As this relationship progresses and becomes perfected, the process is converted into one that is sterile both clinically and by bacteriologic test. Certainly, the environment within this epithelium-lined cavity is highly unfavorable for bacterial multiplication, or even persistence.

These two phenomena just described have one factor in common with the condition found underneath the epithelial attachment covering the enamel surfaces in the gingival region, the interrelationship of tissue changes and the tendency to bacterial invasion. This is merely an extension of a principle that is well known; namely, that one of the most important barriers interposed between the hordes of bacteria outside the body and the more or less defenseless structures within the body has to do with epithelium.

In these generalizations and in the plea that I am making for a more thorough study of the conditions that exist, perhaps I am quite as guilty as those who would, it seems to me, condemn all pulpless teeth on what is, I believe, immaterial and irrelevant evidence; guilty of arriving at somewhat equally sweeping deductions based on equally inadequate data. But what we need most of all is more research like that done by Fish and Maclean in the field of chronic oral infections, by workers in the field of tuberculosis, etc.

In spite of this, I am very much disposed to accept the data and pictures supplied by Fish and Maclean, supplemented by our own bacteriologic and histologic studies, as a very satisfactory foundation for the interpretation of clin-

ical and roentgenographic symptomatology in the management of sick people.

The functional adjustments of the junction of epithelium and tooth substance is of much greater importance than the degree of mechanical attachment of epithelium to enamel, cementum or dentin. Especially is this true with reference to bacteria and their disease-producing activities whether at the neck or at the apex of the tooth.

311 East Chicago Avenue.

WHAT DO YOUR PATIENTS KNOW ABOUT DENTISTRY?

By Edward J. Ryan, B.S., D.D.S., Evanston, Ill.

A QUESTIONNAIRE study was conducted among patients in thirty-seven typical dental practices. Twelve hundred persons responded to twelve simple dental questions. Their replies form the basis of the interpretation given in this article. In this study, an attempt was made to discover what the average patient knew about dentistry. We wished to examine a cross-section of the attitudes of the American public with respect to their dental experience. We hoped from this study to be able to answer, in part at least, the question that you and I frequently ask, "What do my patients know about dentistry?"

Twelve hundred adults answered this inquiry. They were among the patients of thirty-seven dentists practicing in hamlets, small cities and metropolitan communities. Every type of practice was represented, from those comprised of public relief clients to those of exclusive clientèle. The study was not confined to any single geographic area, but covered practices as widely separated as Holyoke, Mass., and San Francisco, Calif.; from Fargo, N. D., to Wisner, La.

The cooperating dentists did not select the persons to receive the questionnaire, but presented it to the first fifty adult patients to come to each of their offices after the study was begun. The patient, without prompting by the dentist or his assistant, answered the twelve questions, and placed the questionnaire in an addressed, stamped envelope and mailed it to me. The cooperating dentists did not see the answers made by their patients.

We believe that a detailed study of the attitudes toward dentistry as expressed by 1,200 dental patients represents a fair sample and an adequate cross-section of opinion. It should be emphasized that the replies were made by dental patients whose knowledge of dentistry may be assumed to be better than that of the nonconsumer of dental service. The facts are presented as revealed in the questionnaires, and the interpretations are based on these facts.

In undertaking this study, we did not set out to prove or disprove anything. We had no preconception to be bolstered and no prejudice to be dispelled. The report represents an exploration among the dental beliefs of the American dental public at the present levels of culture. It is not scientific in the sense that it might prove or disprove a hypothesis, although the study and the tabulations were made with exacting care. It is not a presentation of

(Read before the Section on Dental Economics at the Seventy-Third Annual Midwinter Clinic of the Chicago Dental Society, February 17, 1937.)

major sociologic implications, although it expresses the mass opinions of groups of people on an important social subject.

What were the questions asked and what were the replies? The twelve simple questions were the following:

1. What do you think causes a toothache?
2. Of what use is an x-ray picture of the teeth?
3. What do you think causes tooth decay?
4. Would you like an injection of a local anesthetic while having a tooth drilled?

TABLE 1.—WHAT DO YOU THINK CAUSES TOOTHACHE?

Accident	7
Inflammation	8
Disease condition	11
Pyorrhea	13
Bacteria	16
Food impaction	17
Systemic disturbances	19
Temperature	24
Root involvement	27
Hygiene	31
Combination of factors	33
Diet	37
Miscellaneous	47
Infections (local)	48
Indefinite	52
Abscesses	98
Neglect	103
Decay (cavities)	515
Nerve involvement	538
Total	1,644

5. What is your understanding about pyorrhea; in other words, what do you think it is?
6. How long do you expect dental work that has been done (fillings, bridges, for instance) to last?
7. What relation do the teeth have to general health?
8. Do you think of an extraction of a tooth in the same way as you do of an operation?
9. What do you expect a toothpaste or tooth-powder to do for you?
10. Do you think it is necessary to fill cavities in the "first" ("baby" or "temporary") teeth?
11. Are crooked teeth and poorly developed jaws in children something that they "outgrow"? What are your opinions?
12. What do you think brings about the need for artificial teeth? Do you think it is "just one of those things" that comes with advanced age?

1. WHAT DO YOU THINK CAUSES A TOOTHACHE?

The responses to the first question were certainly intelligent. (Table 1.) People seemed to recognize the association of dental caries, the involvement of the dental pulp and the usual pain that results.

TABLE 2.—OF WHAT USE IS AN X-RAY PICTURE OF THE TEETH?

Germicide		2
Picture		3
Miscellaneous		6
Preventive dentistry		7
Cure or corrective		10
Relation to bone		27
Indefinite or uncertain		37
Diagnostic aid		1425
	Skeptical 9	
	Absolute reliance 77	
	General 625	
	Specific 714	
Total		1,517

As a corollary to this, the replies indicated that patients see a relationship between their own neglect and the result of their neglect; namely, the toothache. This recognition of a causal relationship is encouraging, because it suggests that people are prepared to accept our statement that dental neglect always carries with it the inescapable fact that pain or discomfort will be the price paid. One might expect that among 1,200 patients, there would be a few who would have said that a toothache is due to worms, if they were medieval in their thinking; or due to a form of allergy if they were ultra-modern in their thinking. None of the replies sug-

gested either the imaginative neurotic or the frank ignoramus. We did not record a single absurd answer to this question. The significance, it seems to me, is that the American public is prepared to accept the basic and uncontrovertible truth that dental neglect causes distress; that the dental tissues being what they are, namely, without any pronounced power of regeneration, once destroyed cannot be restored by biologic reparative processes. Unlike many other morbid processes, dental caries does not have peaks and vales of recurrence and remission. Dental caries, in general, is a steadily progressive process which is not self-correcting or self-repairing or self-regenerating. It seems to me that this difference in nature between dental disease and other pathologic processes has never been emphasized strongly enough to our patients.

TABLE 3.—WHAT DO YOU THINK CAUSES TOOTH DECAY?

Erosion or abrasion	8
Combination of factors	9
Infection	12
Calculus and other deposits	24
Uncertain or undetermined (replies vague)	35
Structural defect	41
Accident	42
Acidity	46
Miscellaneous	58
Bacteria	88
Systemic disturbances or deficiencies	132
Deficiency	85
Heredity, pregnancy, prenatal care	32
Gingival involvement	7
Nerve involvement	5
Salivary disorder	3
Food impaction (fermentation and putrefaction)	222
Neglect or improper care	325
Hygienic and other habits	326
Diet	419
Total	1,787

The answers to this question suggest the theme of the educational story that we should tell: that toothache is, as Howard R. Raper says, a preventable condition; that the prevention comes by early treatment of dental caries; that the smaller the dental restoration, the more valuable it is to the patient; that early recognition, which means frequent dental examinations, and early treatment prevent the conditions that follow dental disease, with grim inevitability: toothache, infection, systemic disease and loss of teeth.

2. OF WHAT USE IS AN X-RAY PICTURE OF THE TEETH?

As Roentgen's discovery is only about forty years old, we might expect that there would be a few people at least who had never even heard of an "x-ray." A few did confuse the intent of the question; but the overwhelming response to the question (Table 2) showed that patients recognized the x-ray apparatus as a diagnostic instrument. A study of the replies emphasizes that the public is prepared to accept a form of roentgenographic examination that the profession does not yet take the opportunity to offer. I know a number of practicing dentists who still insist that they only "x-ray suspicious teeth," whatever that may mean; who use the x-ray equipment only sporadically and occasionally; who themselves do not have any faith in the roentgenographic examination. Dentistry is still practiced in many quarters "sight unseen" and price unknown. The roentgenographic examination is too often presented apologetically, as a timid suggestion to the patient.

TABLE 4.—WOULD YOU LIKE AN INJECTION OF A LOCAL ANESTHETIC WHILE HAVING A TOOTH DRILLED?

Question misinterpreted	4
Prefers general or topical anesthesia	10
Skeptical	11
Indifferent	17
Indefinite or uncertain	22
Conditional or restrictive	246
Negative	370
Affirmative	494
Total	1,174

It seems to me that the time is here when we should use the candor in describing the value of roentgenograms to

our patients which they expect from us. We should tell them that without the "x-rays," we are literally working in the dark; we are guessing; we are giving them only half a service. I believe that the responsibility should be the dentist's to impress on the patient the need and the value of roentgenograms, and then the responsibility should be the patient's to have them taken. The patient is doing himself the favor in having roentgenograms taken. When early caries can be detected; when incipient caries can be discovered and early treatment instituted; when beginning periodontal disease is recognized, the patient, I contend, profits more than the dentist. It is only through the intelligent use of the "x-rays" that these early diagnoses can be made. An early diagnosis is to the advantage of the patient: that should be our story.

Popular usage has bestowed the title of doctor on dentists, and dentists have accepted the title. The word doctor originally meant teacher. If we accept the title, we should be ready to accept the responsibility to teach that goes with the title. I believe that dental colleges and dental societies have been grievously remiss in not giving attention in their curricula and programs to educating dentists in the ways and means of teaching their patients.

Table 5.—What Is Your Understanding About Pyorrhea: in Other Words, What Do You Think It Is?

Softening	4
Root involvement	8
Inflammation	11
Poison	12
Deposit; film; food impaction	15
Causes and effects	19
Bacteria	22
Bone involvement	22
Decay	27
Pus	31
Bleeding	31
Diet and neglect	38
Miscellaneous	39
Recession, shrinking, absorption	74
Combination of factors	105
Loosening or loss of teeth	106
Infection	132
Indefinite or uncertain (replies vague)	218
Disease or disorder of the gums	351
Total	1,265

3. What Do You Think Causes Tooth Decay?

I have lived through the bacterial theory; the acid theory; the nutritional theory. The profession is at present deep in the discussions of the endocrinologic theory. We do know and are all agreed on one thing: that dental decay is a complex disease process; that it attacks about 90 per cent of civilized people; that we have no known specific method of prevention, and that our treatment is almost entirely symptomatic and mechanical. It appears that it is a morbid process to which people sometimes develop immunity. How that immunity is acquired, what its nature is, we do not know. This, then, is a rather mournful picture of our lack of knowledge on the subject. The remarkable fact is that, considering our lack of knowledge, our empiric treatment has been notably successful. When we consider that we all have seen dental res-

Table 6.—How Long Do You Expect Dental Work That Has Been Done to Last?

Until extraction	5
Specific duration	16
Miscellaneous	31
Uncertain	59
Indefinitely	104
Lifetime	107
Absolute	87
Qualified	20
Conditional	419
Combination of factors	135
Condition or life of teeth	103
Care and check-up	91
Skill of dentist or quality of work	45
Health	13
Miscellaneous	12
Dentist's discretion	10
Type or position of restoration	6
Cost	4
Variable (six months to a lifetime)	559
Total	1,300

torations that have lasted half a century without recurrence of disease in a tooth, we may be proud that we have been able to do something to check the processes of this malady.

The striking element in the response (Table 3) to the question "What do you think causes tooth decay?" is the number of patients who considered diet a factor and the small percentage who associated caries with bacterial diseases. By assuming that the public receives most of its information first from dentists, and secondly from radio programs and magazine advertising, I have attempted to explain where these patients received the idea that dietary factors were related to dental caries in this extensive proportion. Certainly most dentists do not emphasize this relationship or suggest that there is any specific dietary measure that will prevent tooth decay; and as far as advertising is concerned, advertisers are so busy attempting to discover new chemical elements to drop into their toothpastes, new if fantastic physiologic theories to promulgate and new slogans and epigrams to coin that they have given little attention to the relationship between dental caries and food, except those who have a food product to sell.

Probably it is a fact, however, that when dentists say, "You should drink a quart of milk and a pint of orange juice a day," they are giving the patient the kind of concrete and definite suggestion that he can understand and at which he grasps. On the other hand, if the dentist told the patient to go out and exercise his capillaries or stimulate the endocrins, the patient would leave the office in a haze of confusion. People can comprehend food information, but they cannot grasp bacterial or endocrinologic theories.

When we consider that hundreds of thousands of dollars, yes, millions of dollars have been spent with the emphasis on the particular toothpaste or tooth-powder being advertised, and not on the subject of food relationships and dental caries, we are impressed with the fact that the chance remark of the dentist regarding diet seems to have fallen on fertile soil. It does appear that patients are receptive to the opinions expressed by their dentists —more so than to the information they receive from impersonal advertising. This is another way of saying that people are quick to act according to suggestions concerning the cause of dental disease as well as the treatment, provided the explanations are simply given and can be integrated with their personal experience and knowledge.

The dental profession has a responsibility to the public, a responsibility to tell their patients what is true about dietetics and also what is mere conjecture and even false. A slogan a day will not keep the dentist away nor, as far as we know, will any particular food or concoction act as a sure cure or preventive of dental caries. Proper nutrition is an important factor in health; but it is not the whole story.

TABLE 7.—WHAT RELATION DO THE TEETH HAVE TO GENERAL HEALTH?

Subjective effect	10
Percentage or proportion	15
Health indicator and affected by health	27
Miscellaneous: Combination of factors	38
Functional relation	118
Foci of infection	130
Indefinite (vague)	421
Cause of illnesses	525
Total	1,284

TABLE 8.—DO YOU THINK OF THE EXTRACTION OF A TOOTH IN THE SAME WAY AS YOU DO OF AN OPERATION?

Miscellaneous	6
Indefinite or uncertain (vague)	37
Restricted or conditional	46
Negative (qualified)	66
Affirmative (qualified)	76
Affirmative (absolute)	388
Negative (absolute)	556
Total	1,175

There are other important aspects of hygiene that we must explain to our patients, including the proper use of that simple but essential instrument, the toothbrush.

Thousands of dental patients use their toothbrushes improperly and ineffectively simply because no dentist ever took the time or the trouble to instruct them properly. And why not? Because, I am sorry to record, the dental profession generally has not had the courage to charge a fair fee for instruction in mouth hygiene. A thirty-minute toothbrush lecture and drill and a three dollar fee would have done more to improve the oral health of many patients than most drugs and chemicals. I believe that this is sound thinking.

Our story to the public, whether we tell it individually in our offices or tell it as a profession through some other medium, should emphasize that dental caries is a complex phenomenon which cannot be attacked except by the expert skill of the dentist. The dentist does now and probably always will play the major rôle in the treatment of dental disease. His place cannot be taken by a bottle on the shelf or a package in the pantry.

TABLE 9.—WHAT DO YOU EXPECT A TOOTHPASTE OR TOOTH-POWDER TO DO FOR YOU?

Indefinite	23
Nothing or little	33
Encourage mouth hygiene	34
Miscellaneous	42
Combination of functions	50
Sterilize or disinfect	73
Auxiliary aid	100
Therapeutic or protective function	210
Esthetic or cosmetic function	234
Clean or remove (tartar, stains, film, food particles)	772
Total	1,571

4. WOULD YOU LIKE AN INJECTION OF A LOCAL ANESTHETIC WHILE HAVING A TOOTH DRILLED?

The answers (Table 4) to the fourth question, "Would you like an injection of a local anesthetic while having a tooth drilled?" suggested that the public is escaping from the fear of what they call "the needle." People are receptive and, unfortunately, often gullible regarding anesthetics in dentistry. Some of them even follow the neon signs that say "Gas" and with a full stomach approach the office of the advertising dentist to have teeth extracted. Few of them ever ask what particular concoction of "gas" is being used. The point is that apparently people have a solid confidence in the judgment of the dentist they visit. Sometimes, regrettably, they have too much confidence. Although many of them prefer a local anesthetic, the results of this survey indicate that, for the most part, patients are ready to abide by the decision and advice of the operator. They do not come into the dental office and order a local anesthetic as they would order ten gallons of gasoline for their automobiles. The patient's willingness to leave the question of an anesthetic to the judgment of the operator is excellent evidence of his trust in and respect for professional opinion. Most people are willing that we take the professional responsibility. It is this kind of trust that makes dentistry a profession. It is the value that we must preserve.

TABLE 10.—DO YOU THINK IT IS NECESSARY TO FILL CAVITIES IN THE "FIRST" ("BABY" OR "TEMPORARY") TEETH?

No (qualified)	9
Recommendation of dentists	9
Extraction, not restoration	12
Advisable or preferred	19
If painful or decayed	19
Sometimes	24
Yes (qualified)	30
Indefinite	64
No	192
Yes	807
Total	1,185

One of the interesting sidelights on this question of an anesthetic has to do with the Hartman solution. Although many of these questionnaires were prepared at the time the Hartman solution was being ac-

claimed, less than ten patients indicated their belief in a topical or surface application, and not one mentioned the Hartman solution by name. Despite the fact that the announcement of the Hartman solution was the most circulated dental story in history and one in which all the modern facilities and mechanisms of publicity were employed, not one patient associated the publicity story with his own dental needs or experience. This would appear to refute the alleged power of publicity in educating the public and seems to indicate that patients do receive most of their information in the dental office.

TABLE 11.—ARE CROOKED TEETH AND POORLY DEVELOPED JAWS IN CHILDREN SOMETHING THAT THEY "OUTGROW"? WHAT ARE YOUR OPINIONS?

Answers	
Conditional	6
Affirmative	24
Indefinite or uncertain	56
Question misinterpreted	82
Limited or restricted	201
Negative	800
Total	1,169

Opinions	
Cost prohibitive	4
Outgrown	5
Extraction preferred	5
Correction impossible	9
Not outgrown	11
Miscellaneous	15
Diet	22
Causative factors	31
Neglect and prevention	56
Orthodontia or dental service	594
Total	752

5. WHAT IS YOUR UNDERSTANDING ABOUT PYORRHEA? IN OTHER WORDS, WHAT DO YOU THINK IT IS?

It is probably expecting too much of patients to think that they might know anything about the nature of a disease process that we do not understand very well ourselves. The response to this question (Table 5) was a reflection of the lack of information about pyorrhea on the part of the profession itself. If guessing exists any place in dentistry, it does with regard to this subject of pyorrhea, regardless of what polysyllabic word is used to describe this condition. We seem to have more terms for the disease than we do knowledge of the nature of the disease. Second only to the number of names for the condition are the kinds of treatment suggested. Some have seen amebae squirming around in pyorrhea pockets; others see calcium dancing to and fro in the interstices of the bone; still other men have demonstrated lethal bacteria in pockets; and, as far as treatment

TABLE 12.—(a) WHAT DO YOU THINK BRINGS ABOUT THE NEED FOR ARTIFICIAL TEETH? (b) DO YOU THINK IT IS "JUST ONE OF THOSE THINGS" THAT COMES WITH ADVANCED AGE?

(a)	
Combination of factors	9
Old age; inevitability	23
Appearance	28
Accident	32
Miscellaneous	65
Infections; abscesses; diseased teeth or gums	69
Functional or structural disorders	113
Systemic disorders	115
Diet; medicines	117
Decay; pulp removal; pyorrhea	131
Indefinite	169
Neglect; improper care; fear	737
Total	1,608

(b)	
Should not be true	4
Any age	6
Miscellaneous	9
Age relation	12
Neglect; improper care; diet; sickness; modern civilization; other factors	25
Conditional	31
Uncertain or indefinite (vague)	39
Affirmative	71
Can be deferred	86
Partly or often	176
Negative	679
Total	1,138

is concerned, the chemist, the surgeon, the curettor, the vitamin C addict, the electrocoagulator—all have had their flash at treatment. So far, the disease has quite stubbornly resisted all attacks; as stubbornly, I may say, as the common cold or falling hair have resisted all specific preventives.

Apparently, people have a vague idea that pyorrhea is a disease of the gums and the bone; that teeth are lost; that it is some sort of fearsome melting away of tissue. Pyorrhea is, in the minds of the public, something to be conjured with, a weird, mysterious malady. It seems to me that if we would tell patients what we do know about this disease: that it is of both local and general origin; that the local causes can usually be corrected and satisfactory treatment instituted by a dentist, and that the general factors are pretty much beyond our control, we would have told a story that is both encouraging to the public and is truthful. We must be prepared to point out that a blood-tinted toothbrush is not necessarily a sign of doom, nor are white pearly teeth always set in healthy bone. People have been led by advertisers to fear a drop of blood and to venerate seductive white teeth. The drop of blood may not portend pyorrhea and the white teeth may be undergoing attack by periodontal disease. But advertisers alone have not perpetuated these fallacies. I know of so-called periodontal surgeons who hack away with their scalpels or electrocoagulative points all tissue that shows inflammation, despite the known fact that inflamed tissue often marks a defense mechanism to irritation. Then, too, there are the seers who look at a white tooth and arrive at the decision by the powers of clairvoyance that the underlying bone must also be white and normal.

In interpreting the answers to this question further, we arrive at the same place that we have reached in other questions; namely, that the function of dental patient education is first to inform people correctly according to the degree of our knowledge, and, second, to correct the misinformation which they have received from other sources. We are convinced that the story can best be told to individual persons in the dental office rather than to the public *en masse*. Of the 1,200 patients, only nine showed a reaction to this question which might have been due to advertising propaganda. This seems highly important. In view of the extensive campaigns and thousands of dollars that have been spent by dentifrice manufacturers on this subject, the inference may once again be made that general advertising or so-called dental health education is not so potent as is commonly supposed.

6. HOW LONG DO YOU EXPECT DENTAL WORK THAT HAS BEEN DONE (FILLINGS, BRIDGES, FOR INSTANCE) TO LAST?

Automobile manufacturers change their styles yearly. Clothing designers do likewise. Architectural changes are slower, but inevitable. People are led to anticipate improvement in models and styles in mechanical and material things. Despite the technologic advances in dentistry —the development of the gold inlay, the ceramic art, new dental bases—many of us are still practicing outmoded dentistry. One reason for this is that it is probably too much of an effort to learn new technics, particularly when we think that we are not receiving a just fee for our improved efforts. We have taught people either by direct statement or by implication that there are "permanent" dentures and "fixed" bridges. We use the terms of the indestructible and the timeless to describe mechanical things that are subject to friction and wear and use. We tell people that dentistry can defy the laws of mechanics and dynamics and last a lifetime, as I have heard dentists say; or last for twenty or twenty-five years—arbitrary figures caught from the thin air. To do this is to misrepresent dentistry to the public. There can be no such thing

in living, moving, vital tissue as permanence.

The misconception that the public has (Table 6) regarding the length of service that dental appliances can give is of our own creation. People pay a thousand dollars for an automobile, but they are conditioned to believe that although it is an expensive item, the automobile should be exchanged in, say, two years, not because it is worn or refuses to go, but because there is something better in the field. Why should we not tell people who have worn old septic fixed bridges or "tin-can" crowns or ghastly rubber dentures with grave-marker teeth that, although such dental work was acceptable in the era when it was done, we now have something better? Why should we not tell patients that there is now something more lifelike and more acceptable than vulcanite dentures? Why should we not tell people with worn prostheses (and prostheses do wear out) that they should be replaced? Why should we not replace prostheses that no longer have form or function with those that have? In making such suggestions, it is not necessary to make any odious comparisons or inferences that could be misinterpreted by the patient as fault-finding with the kind of dental treatment that was previously received. It is a truism worth repeating that nothing is ever gained by "knocking" another dentist.

People do not wait for a blow-out before they buy a new set of tires. Why should they wait for acute pain and distress before they seek modernized dental service? The automobile carries a guarantee of sixty or ninety days; clothing, no guarantee at all; nursery stock, to quote a sign I saw some time ago, is sold with the warning: "Our guarantee: We do not guarantee our goods after they leave this place." But at least by inference, we apparently still misrepresent our services by inferring to our patients that what we have created as dental art is as indestructible as the pyramids.

Certainly I do not want to be misunderstood as making a plea for careless "slam-bang" dentistry so that people will have to come back and have replacements made. Not at all. My plea is that we should not give the implied guarantees; we should not give the false impression and the false sense of permanence. How many dentists have had a patient return after seven or eight years with one of their inlays in his hand? How many ever had a clasp break or a tooth become lost from a denture after three or four years? How many ever had a patient say, "Well, Doctor, this inlay has been in a long time; this clasp has given grand service, or this denture has served me well"? Do they say that? Not at all. Either directly or by inference, they let the dentist know that they do not expect inlays to come out or breakage to occur, for did not the dentist say that it was a permanent denture or a fixed bridge, or use some other implication of longevity? The fault, like most of our economic difficulties in dentistry, is of our own creation.

7. WHAT RELATION DO THE TEETH HAVE TO GENERAL HEALTH?

Apparently, patients are clearly aware of three relationships between the dental tissues and general health (Table 7): It is recognized (1) that diseased teeth can be a cause of general ill health because of infection; (2) that the loss of teeth and consequently the loss of masticatory function can be a cause of ill health, and (3) that the teeth can be influenced by the condition of health. The patient understands that disease of the teeth can be the result of ill health as well as ill health the result of disease of the teeth. In general, it may be concluded that the health significance of dentistry is generally accepted and appreciated. In the patient's mind, at least, the mouth is regarded as an integral part of the body. The public seems ready to accept the health story of dentistry. I doubt whether we have told the story with the emphasis that it deserves.

8. DO YOU THINK OF AN EXTRACTION OF A TOOTH IN THE SAME WAY AS YOU DO OF AN OPERATION?

The number of patients who did not consider the extraction of a tooth as an operation was greater than the number who did consider it as an operation. (Table 8.) This attitude probably also reflects traditional patterns of thought, inherited from our dental precursors and the public. It must be remembered that dentists themselves, despite frequent and severe complications incident to extraction, still consider tooth removal as a casual procedure. This casual behavior of the dentist has at times given the patient a false assurance of safety. We would decry any attempt at overdramatization of tooth removal or any overexpression of its dangers or hazards. If, however, dental extraction is to be done under accepted surgical conditions, precautions are in order and the public should be taught the value and importance and seriousness of such procedures.

The general press treats accidents attending tooth extraction and deaths in dental chairs as news. This is because in the eyes of newspaper men and the public alike the dental operation is no operation at all, and consequently no accidents or deaths should ever result. The attitude of the public toward operations on dental tissues is a result of underemphasis on the part of the profession.

9. WHAT DO YOU EXPECT A TOOTHPASTE OR TOOTH-POWDER TO DO FOR YOU?

Clearly, dentists and not advertisements have determined the patient point of view toward dentifrices. (Table 9.) Despite the widespread and expensive advertising of products to which some dentifrice manufacturers give a therapeutic or curative or corrective implication, the public who are dental patients apparently believe a dentifrice to be primarily if not solely an aid in cleaning the teeth. The response to this question suggests the opportunity that dentifrice manufacturers might have in a cooperative campaign with the dental profession to teach the truths of dentistry to the public. By a combined effort, they could disseminate essential oral hygiene information rather than laud their own products as panaceas for dental ills. A cooperative campaign to carry the facts of dentistry to the public could be augmented by dignified *individual* advertising to direct the public to specific products. This is certain: the more accurate and wide-spread the knowledge of dental conditions, the greater the amount of dentifrices of all kinds that will be sold. It is predicted that consumers would buy the same proportion of each product under a cooperative management that they buy now because they buy according to taste or color or price or some other personal preference.

Any attempt to dignify a toothpaste or tooth-powder by representing it as a therapeutic agent or a curative drug is entirely inconsistent with our knowledge of the nature of dental disease. Dental disease cannot be prevented or cured by any known drug or combination of drugs, and certainly not by a dentifrice. Dentifrices are essentially cleaning and cosmetic agents, like soap and perfumes. We have witnessed controversies raging around the dentifrice situation in dental circles. On one side are alined those manufacturers who vie with one another in the extravagance of their claims; on the other side are alined a group of zealous dentists lending dignity to a subject by contentions carried beyond all merited proportions. By indirection, this group has attributed to dentifrices the value of a therapeutic agent, which they do not have. If this controversy had not been instigated and encouraged, it is likely that a mutually beneficial educational campaign could have been developed in which the profession and every manufacturer cooperated to the advantage of the public, the profession and the manufacturers. It may not be too late to organize such a cooperative educational program.

The answers to this question, "What do you expect a toothpaste or tooth-powder to do for you?" suggest that the manufacturers, with their unnecessary use of superlatives and exaggeration, on the one hand, and the zealous group of dentists, with their insistence on the therapeutic classification of dentifrices, on the other, have both been wrong. The persons who answered the questionnaire have been influenced by practicing dentists who have neither the commercial point of view of the manufacturers nor the critical zeal of the Council on Dental Therapeutics. The average dentist and his patient are apparently closer to the truth than is either the copywriter for the offending dentifrice advertisers or the Council on Dental Therapeutics. The patient and the practicing dentist classify a dentifrice where it rightly belongs—as an auxiliary to oral hygiene. Any dentifrice manufacturer seeking a new theme for his copy, and willing to display daring and originality, might tell candidly the stark story of the uses, advantages and limitations of dentifrices. He would probably receive ready support from both profession and public.

10. DO YOU THINK IT IS NECESSARY TO FILL CAVITIES IN THE "FIRST" ("BABY" OR "TEMPORARY") TEETH?

In the ratio of about 4 to 1, patients indicated their belief in the care of the deciduous dentition. (Table 10.) Such a response is encouraging, although it is doubtful whether the public practices the belief so generally expressed.

11. ARE CROOKED TEETH AND POORLY DEVELOPED JAWS IN CHILDREN SOMETHING THAT THEY "OUTGROW"? WHAT ARE YOUR OPINIONS?

Again, we must be impressed with the accuracy of the information that the public has on this subject; likewise, with its attitude on the correction of malocclusion. (Table 11.) Almost every one believed that orthodontia is advisable in indicated cases. Although orthodontia is accepted in the survey as being a service of genuine value, we encountered frequent complaints from persons regarding the expense of orthodontic care. In the eyes of the public, orthodontia is still a luxury. I have the utmost respect for the accomplishments of orthodontic science and art. I believe, however, that the time has come when orthodontists individually and collectively should give attention to the economic restrictions of orthodontic care and should formulate plans whereby their services can be made available to patients without the expenditure now necessary.

12. WHAT DO YOU THINK BRINGS ABOUT THE NEED FOR ARTIFICIAL TEETH? DO YOU THINK IT IS "JUST ONE OF THOSE THINGS" THAT COMES WITH ADVANCED AGE?

We attempted to determine whether people considered the need for dentures as an expression of the aging process. We wondered whether people considered the loss of teeth as inevitable, *i.e.*, in the same category as graying or loss of hair. In none of the questions were the answers so dramatically interesting as in this one. (Table 12.) Patients for the most part believe that loss of teeth is occasioned by neglect, improper care and fear. Only twenty-three persons indicated their belief in the inevitability of dentures. If, as the response to this question reflects, the appreciation of the public is so fine and the value of preventive measures and early and constant dental care is acknowledged, we have every reason to be hopeful. The further promotion of this preventive point of view should be the motif of any educational undertaking.

SUMMARY

1. Patients seem to be less susceptible to the influence of advertising than is generally supposed. Apparently, when there is a conflict between the information of advertising copy and that obtained from the dentist, the patient finds himself on the side of the dentist.

2. Patients seem ready and eager to obtain their information from their dentists. Their lack of information seems to indicate that dentists are often remiss in their duty as informer to the patient. Their misinformation may be due to other influences, such as advertising; or to misconstruing what their dentists have said. The place to educate the patient seems obviously to be in the dental office, the dentist fitting the story to the dental needs and the mentality of the patient. The function of dental patient education is, first, to inform people according to their degree of our knowledge, and, second, to correct their misinformation. The story can best be told to individual persons in the dental office rather than to the public *en masse*.

Popular usage has given dentists the title of doctor and they have accepted it. The word doctor means teacher. If we accept the title, we should be ready to accept the responsibility to teach that goes with the title. I believe that dental colleges and dental societies have been grievously remiss in not giving attention in their curricula and programs to educating dentists in the ways and means of teaching their patients.

3. Patients generally recognize toothache as the result of their own neglect. That dental disease is not self-correcting and must be arrested by the dentist's intervention should be more strongly emphasized to patients.

4. The complexity of dental caries should be emphasized to patients who seem to attribute too much to dietetics. Patients seem to have an exaggerated conception of the place of diet in dental caries. The dentist's place cannot be taken by a bottle on the shelf or a package in the pantry.

5. Patients seem ready to rely on the judgment of the dentists they visit. It is for the dentists to make frank suggestions as to procedure; such as the advisability of having "x-ray" pictures taken or the advisability of anesthesia or hospitalization.

6. The implied guarantees of permanence and longevity should be discouraged. Patients should understand that restorations are subject to the same laws of mechanics and dynamics as are all material objects. There can be no such thing as permanence in living, moving, vital tissue.

7. The public seems ready to accept the health story of dentistry. It is the dentist's responsibility to tell it.

8. If dental extraction is to be done under accepted surgical conditions, precautions are in order, and the public should be taught the value and importance and seriousness of such procedures. The attitude of the public toward operations on dental tissues results from underemphasis on the part of the profession.

9. The patient and the dentist classify a dentifrice where it rightly belongs, as an auxiliary to oral hygiene. Both the Council on Dental Therapeutics and the dentifrice manufacturers would do well to follow this lead.

10. Belief in the care of the deciduous dentition was generally expressed. It is for the dentist to encourage his patients to put this belief into practice.

11. The advisability of orthodontia is generally accepted. Cost seems to be the chief deterrent.

12. Finally, people see that as far as dental disease is concerned, they cannot escape from paying the price of their neglect. Fear of pain and of cost engenders this neglect. To conquer their fear of pain and of cost, we offer early dental care. Neglect carries with it unfailing pain and expense. I can think of no better motif for any dental health educational effort than this: "Dental neglect costs more than treatment, in pain, in time and in money."

EXPERIMENTAL PRODUCTION OF THE DIFFUSE ALVEOLAR BONE ATROPHY TYPE OF PERIODONTAL DISEASE BY DIETS DEFICIENT IN ASCORBIC ACID (VITAMIN C)*

By Paul E. Boyle, D.M.D., Otto Bessey, Ph.D., and S. Burt Wolbach, M.D., Boston, Mass.

An important step in the elucidation of any disease process is the production of its anatomic features in an experimental animal where it may be studied under adequately controlled conditions. The present report deals with the production of the diffuse atrophy type of pyorrhea in the guinea-pig by means of diets deficient in vitamin C.

The incisor teeth in man and in the guinea-pig are suspended chiefly from a thick lingual plate of alveolar bone. (Figs. 1-2.) Normal incisal function tends to force the teeth into their sockets and toward the labial crest of the alveolar process. Occlusal forces are controlled by the hydraulic effect of compression of the soft tissues and blood vessels of the periodontal membrane and by the snubber effect of the tendinous fibers of the periodontal suspending apparatus. Tooth movement is limited by the extensibility of these tendinous fibers. Pressure on the teeth is ultimately transmitted as tension to the alveolar bone. Direct pressure of the teeth against the alveolar process is impossible as long as the suspending apparatus remains intact.

(Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry [Research] at the Seventy-Ninth Annual Session of the American Dental Association, Atlantic City, N. J., July 14, 1937.)

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In pyorrhea alveolaris, the tissues which surround the teeth are destroyed, and the teeth become loose, and are eventually lost. This process may start as a local inflammation of the gingival tissues incidental to trauma or infection. Impaction of food on the interdental papillae, accumulation of débris and calcareous deposits in the gingival crevice and Vincent's infection are examples of local pyorrheic processes.

In addition to local factors in pyorrhea, underlying or systemic factors have long been sought.[1] In certain cases, loosening of the teeth occurs in the absence of recognizable local factors and thus appears to be the result of systemic conditions only. In such cases, the teeth wander in directions determined by occlusal forces. The periodontal membrane is widened and x-ray examination discloses a marked rarefaction of the alveolar bone. The descriptive term "diffuse alveolar bone atrophy" has been applied to this type of pyorrhea.[2] Pocket formation, while common in the early stages of the local type pyorrhea, is a relatively late complication, if it occurs at all, in the diffuse atrophy type.

Occlusal forces are of importance in localizing both types of pyorrhea. Relief of traumatic occlusion is an aid in the treatment of this disease. Traumatic occlusion cannot, however, be properly considered the etiologic agent of pyorrhea,

for two reasons: First, teeth subjected to most severe occlusal stress in man and in laboratory animals usually develop periodontal structures capable of withstanding such stress. In such cases, compensatory hyperplasia of the cementum, periodontal fibers and alveolar bone takes place. Second, periodontal disease frequently occurs in mouths in which the distribution of occlusal forces is optimal.

Attempts to produce periodontal disease of the systemic type in laboratory animals have hitherto been unsuccessful. Such attempts have consisted, for the most part, of the application of excess occlusal forces[3] or of orthodontic forces,[4]

Fig. 1.—Diagram of human incisor tooth and suspending apparatus. The relative thickness of the labial and lingual alveolar bone is to be noted.

without interfering with the underlying ability of the tissues to adapt themselves to such forces.

Except for the work of Howe,[5] who described clinically observable changes in the teeth and paradental structures of vitamin C-deficient guinea-pigs, there have been few reports of attempts to produce periodontal lesions by interfering with the ability of the tissues to compensate for functional wear and tear. Experimental rickets[6] and vitamin-A deficiency[7, 8] in laboratory animals have been shown to affect the paradental structures, but the lesions produced do not resemble clinically or histologically human systemic periodontal disease.

The fundamental phenomenon of scurvy as enunciated by Aschoff and Koch[9] and corroborated by Höjer[10] and by Wolbach and Howe[11] is that, in the absence of vitamin C, certain cells of mesenchymal origin are unable to produce normal intercellular substances. Failure of connective tissue cells to form collagen fibers and of odontoblasts and osteoblasts to form the collagenous matrices of dentin and bone adequately accounts for the clinical symptoms of scurvy. Rate of growth and mechanical stress incident to function determine the local-

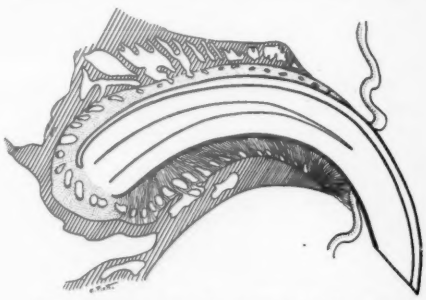

Fig. 2.—Diagram of guinea-pig incisor tooth and suspending apparatus. Dense lingual anchorage bone is situated on the lingual (concave) side. Trabecular bone on the labial, enamel covered side is subjected to hydraulic pressure forces in mastication.

ization of bone fractures and hemorrhages. This fact is well illustrated by the loosening of the teeth of man and of laboratory animals in scurvy.[12]

In spite of the fact that pathologic changes in the periodontal tissues have long been recognized as cardinal signs of scurvy, but few histologic reports of these tissues are found in the literature. Westin,[13] in an extensive monograph on tooth changes in cases of human scurvy, describes x-ray and histologic alterations in the periodontal tissues. Among the

Fig. 3.—Crest of alveolar process in adult human being; normal alveolar bone, collagen fiber and cementum suspending appartus. (×110.)

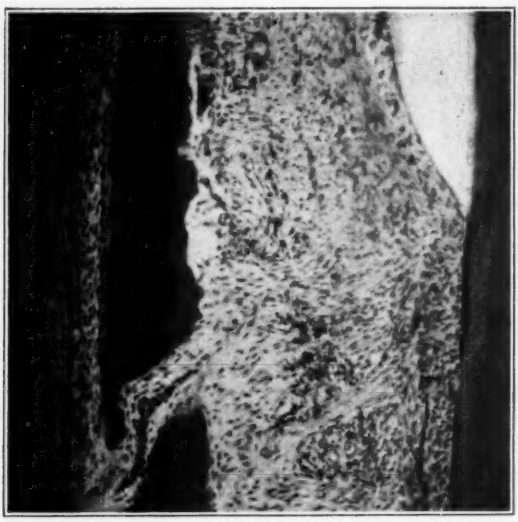

Fig. 4.—Human scurvy in infancy: Crest of alveolar process undergoing atrophic change, particularly on side nearest tooth surface. The periosteum is separated from the alveolar bone by a cellular and hemorrhagic infiltration. Atrophy of fibers of the peridental membrane and a small area of resorbed cementum are evident. (×110.)

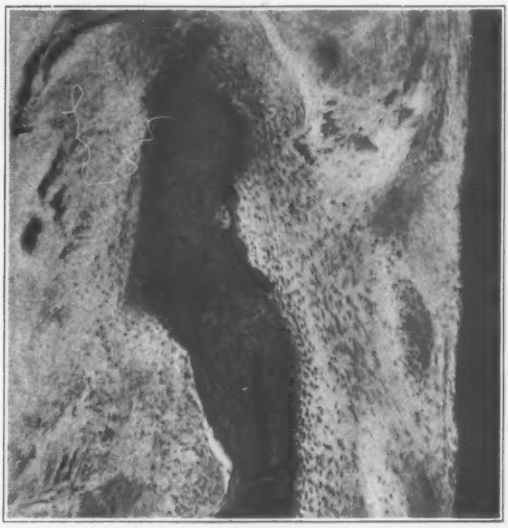

Fig. 5.—Crest of alveolar process in adult human tooth; systemic pyorrhea (diffuse atrophy). The similarity to human and guinea-pig tissues in ascorbic acid deficiency is evident. (×110.)

Fig. 6.—Crest of alveolar septum in adult human being. Atrophy of bone, collagen fiber suspending apparatus, resorption of cementum and fibrous marrow spaces are to be noted. (×28.)

changes described are marked widening of the periodontal space, resorption of the cementum and the alveolar bone, especially at the crest of the alveolus and about the apex of the tooth root, hemorrhage, osteoporosis and disappearance of the hematopoietic tissue of the marrow spaces. Because of the absence of pocket

formation, which he regarded as pathognomonic of pyorrhea, and apparently unaware of the almost identical histopathology of the diffuse alveolar bone atrophy described by Gottlieb,[2] Westin ruled out scurvy as of importance in the causation of this disease.

Further evidence of the similar histopathology of vitamin-C deficiency and diffuse alveolar bone atrophy has been gained from a study of the jaws of infants,[18] where the diagnosis of scurvy was made clinically and established by pathologic studies. The changes in the alveolar bone are identical with those in the experimental animal and, except for the complications incidental to infectious processes, with adult Type II peridental disease. (Figs. 3-8.)

Fig. 7.—Crest of alveolar process in guinea-pig molar tooth; basal diet plus 5 mg. of ascorbic acid daily (normal control). (×110.)

As one phase of a research project having as its aim characterization of the nutritional requirements of tooth formation and maintenance, a study of various degrees of ascorbic acid nutrition in the guinea-pig has been undertaken.[15] Animals have been kept on a vitamin-C-free diet, supplemented by measured amounts of ascorbic acid (0.3 to 5.0 mg. *per diem*). Negative control groups on the basal diet alone and positive control groups on greens, in addition to those on the higher levels of ascorbic acid, have also been studied. The rate of growth of the teeth of animals in various degrees of ascorbic acid nutrition has been measured. The rate of growth of one incisor in occlusion with the teeth of the opposing jaw has been compared with that of the other incisor, which has been kept out of occlusion by repeated clipping. At necropsy, the head of the animal to be examined has been severed from the body, split in a sagittal plane and roentgenographed. Ground and decalcified sections in cross and in longitudinal planes, of both incisor and molar teeth and paradental tissues, have been prepared for microscopic examination.

In acute scurvy, the paradental tissues of the guinea-pig are weakened and gross

loosening of the teeth occurs. Congestion of the gingivae is a constant finding. In most instances, pocket formation does not take place. In rare cases, however, typical pocket formation occurs, with calcareous deposits attached to the enamel surface, keratinization of the epithelium lining the pocket and acute inflammation of the underlying tissues. (Figs. 9-10.)

Fig. 8.—Crest of alveolar process in guinea-pig molar tooth; basal diet plus 1 mg. of ascorbic acid daily (chronic scurvy).

In the moribund animal, the teeth may easily be extracted. X-ray (Fig. 11, right and center) and histologic examinations reveal marked rarefaction of the alveolar bone and widening of the periodontal membrane. These changes are conspicuous over the labial enamel-covered part of the incisor teeth in the region anterior to the fulcrum of tooth movement. They are explained as the result of pressure on this region, incidental to loosening of the teeth. In the normal animal, the stress of occlusion is transmitted by way of tension on the peridental fibers to the alveolar bone. This suspending apparatus allows limited movement of the tooth. At all times, an ample width of cushioning soft tissue remains between the tooth surface and the alveolar bone in the region oppo-

site the part of the paradentium placed under tension by the occlusal force exerted. In acute scurvy, the collagen fiber formation that normally accompanies continuous eruption of the tooth fails to occur. This failure results in weakening of the suspending apparatus. This apparatus is further weakened by a generalized rarefaction of bone resulting from the inability of the tissues to form new bone matrix in the absence of ascorbic acid. Ultimately, the periodontal fibers are unable to sustain the forces exerted in mastication, the teeth become loosened and it seems reasonable to assume that the animal on a deficient diet exerts less than normal masticatory force. In spite of reduced functional demands, the breakdown of the suspending apparatus, with resultant loosening of the teeth and atrophy of the overlying bone, occurs.

On low levels of ascorbic acid administration (0.3 to 1.0 mg. daily), animals have been maintained for periods up to six months. Such animals show less than normal growth and weight increase rates. The incisor teeth renew themselves in approximately sixty days, which is nor-

Fig. 9.—Section from guinea-pig with acute scurvy after deficiency diet of sixteen days' duration. There is pocket formation on the labial enamel-covered surface of the incisal tooth. (×28.)

pressure atrophy of the bone in the direction toward which they are forced in mastication, i.e., toward the labial alveolar bone, results.

In acute scurvy, only the formative end of the tooth consists of structures laid down during the scorbutic régime. The incisal part of the tooth consists of structures formed before the animal was placed on the deficient diet. The angle of wear of the incisal edge remains normal. The scorbutic animal consumes less food than does the normal control animal, and mal. The tooth structures formed during the experimental period are fragile, and spontaneous fractures occur frequently. Such teeth are much less firmly attached to the jaws than the teeth of animals on the control diets. X-ray examination reveals an irregularly flattened curvature of the teeth, the presence of rarefied bone and widening of the shadow cast by the periodontal membrane, particularly over the anterior part of the enamel-covered surface. (Fig. 11, right.)

Histologic examination reveals a com-

pensatory hyperplasia of the cementum, presumably in response to the loosening of the tooth. The alveolar bone is less dense than normal and shows extensive osteoclastic resorption, especially in the labial alveolar plate. The fiber bundles of the suspending part of the periodontal membrane are less conspicuous than in normal animals. The mitotic figures normally found among the cells of the periodontal membrane are greatly reduced in numbers, particularly in the region of greatest stress, i.e., near the crest of the lingual alveolar bone plate.

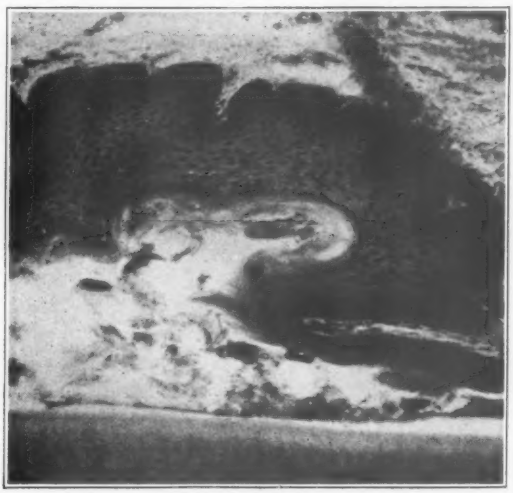

Fig. 10.—Higher magnification at depth of pocket, showing keratinizing epithelium and calcareous deposits. (×110.)

Thus, in both acute and chronic ascorbic-acid deficiency, generalized rarefaction of the bone occurs. This rarefaction, a result of the inability of the osteoblastic cells to form bone matrix, is accompanied by a similar failure of the fibroblastic cells to form collagen fibers. The loosening and wandering of the teeth is an expression of the weakness of the bone and collagen-fiber suspending apparatus. The histologic details of atrophy of the bony, fibrous and hematopoietic tissues in the tooth and mandible are the classic changes of scurvy. Such atrophic changes likewise are the characteristic features of periodontal disease of the diffuse atrophy type.

COMMENT

Although the cardinal signs of scurvy, which include loosening of the teeth and bleeding from the gums, have previously suggested a possible etiologic relation to pyorrhea alveolaris, satisfactory evidence of their interrelation has not heretofore been presented. Pathologists familiar with the characteristic phenomena of experimental scurvy have concentrated on the striking changes in the dentin and dental pulp and have paid little attention to the equally important but histologically less obvious changes in the periodontal structures. On the other hand, those investigators who have most adequately described the histopathology of periodontal disease have apparently been unaware of the close similarity of their findings to the characteristic features of human and animal vitamin C deficiency. The pathol-

ogy of scurvy may be summarized as an inability of cells to form normal intercellular substances. The pathology of the diffuse atrophy type of pyorhea may likewise be summarized as an inability of the periodontal tissues to form their normal intercellular substances, with resultant inability to compensate for the wear and tear on cementum, collagenous fibers and alveolar bone.

It has been axiomatic since the work of Wolbach and Howe that normal healing of wounds can occur only when adequate ascorbic-acid nutrition is maintained. As a corollary, it is certain that normal maintenance of the periodontal tissues can be assured only when the vitamin C nutrition is adequate. This applies not only to the maintenance of the periodontal tissues as far as withstanding occlusal function is concerned, but also to the normal healing of wounds after tooth extraction or other surgical operations. In addition, the prognosis of orthodontic or of prosthetic procedures depends, in part, on normal ascorbic-acid metabolism.

The fact that vitamin C deficiency is a systemic factor underlying diffuse atrophy pyorrhea does not eliminate the importance of any of the other previously recognized conditions which may lead to periodontal disease. Just as wound healing may have factors other than the amount of vitamin C in the diet, notably the degree of infection present, so may numerous local and systemic conditions predispose to disease of the periodontal tissues. Likewise, vitamin C therapy should not be considered a panacea for dental ills. Even though inadequate vitamin C nutrition may have played a part in the development of pyorrhea, complete repair is probably impossible once pocket formation has occurred. Furthermore, local trauma, infection or senility may cause eventual exfoliation of the teeth in human beings adequately nourished with regard to ascorbic acid, as well as in ani-

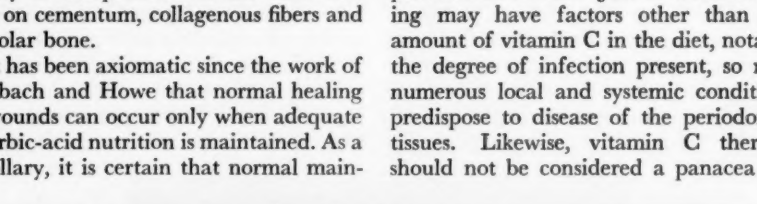

Fig. 11.—Left: Roentgenogram of incisor teeth of normal guinea-pig. The dense lingual anchorage bone and the width of the periodontal membrane shadow are to be compared with similar factors in Figure 11, center (x-ray exposure factors constant). Center: Acute scurvy, basal diet alone for twenty-six days. There is rarefaction of the lingual alveolar bone and an increase in width of the periodontal membrane, particularly over the anterior labial surface of the incisors. Right: Chronic scurvy in animal on basal diet plus 0.3 mg. ascorbic acid daily for 155 days. There is irregular curvature and spontaneous fracture in the teeth formed during the experimental period, as well as atrophy of the anchorage bone and an increase in width of the periodontal membrane.

mals, such as the dog, in which optimal ascorbic acid nutrition is assured by the animal's ability to synthesize this substance. Vitamin C, while absolutely essential for the formation of normal bone, dentin and connective tissue, is nevertheless only one of the many known and unknown substances necessary for the carrying on of these vital processes. Nevertheless, it should be emphasized that inadequate vitamin C nutrition is frequently encountered among the routine patients of the dental clinic. Among sixty-six patients examined by Weisberger[16] at the Harvard Dental School, more than half had blood ascorbic values well below normal (less than 0.5 mg. per cent). All of these patients had marked periodontal disturbances. Ten of these patients in the low level range were given pure vitamin C by mouth and showed clinical improvement in the periodontal structures coincident with increase in the blood ascorbic values.

At the present time, the state of vitamin C nutrition can be determined by laboratory tests in much the same way that the state of carbohydrate metabolism can be determined. In all cases of periodontal disease, it should be ascertained that the ascorbic acid nutrition is normal before treatment by operative procedures is undertaken.

SUMMARY

The essential characteristics of ascorbic acid deficiency and of diffiuse alveolar bone atrophy pyorrhea are identical and may be summarized as an inability of bone and connective tissue to withstand functional stress. The gross, x-ray and histologic variations in the periodontal tissues of the guinea-pig maintained on diets deficient in ascorbic acid are pathognomonic of scurvy and reproduce the diagnostic features recognized as characteristic of human diffuse atrophy pyorrhea.

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NEXT STEPS IN PUBLIC HEALTH

By Thomas Parran, Jr., M.D., Washington, D. C.
Surgeon General, U. S. Public Health Service

Edmund, Earl of Derby, who dyed in Queen Elizabeth's days, was famous for chirurgerie, bonesetting, and hospitalitie.

So records the diary of John Ward, a seventeenth century vicar of Stratford-on-Avon. That phrase with its medical flavor has an aptitude for this gathering. There is, in the first place, the warm hospitality of your welcome and my own personal friendship with many of you. But there is, beyond that, the warmth and hospitality which have marked all the relations of the American Dental Association with the United States Public Health Service.

There is no group with which we have worked more happily than with yours. Yours were among the strongest shoulders put to the legislative wheel a few years ago when the Public Health Service was reorganized on more effective lines. Your active interest in the preventive aspects of your medical specialty places your philosophy particularly close to that of those who work in public health. You have cooperated with us actively in numerous studies and investigations. In the Public Health Service, the dental surgeon works in his rightful place as a commissioned officer with status equal and identical in every way to that of his medical and engineering colleagues.

I would emphasize that status of colleagueship. It was once customary, I believe, for a physician addressing a group of dentists to begin his remarks with a reference to Paul Revere. The reference was not to that gripping night when Paul peered through the mouth of the Charles River to discover whether one or two of the cavities in the North Church tower would glow with gold, but to those later days when he was a dentist to the Boston brahmins and member of Boston's first board of health.

It was a good beginning for a physician. It gave him self-confidence before your profession. It served to remind him and his audience that medicine is a senior branch and that dentistry began as an incident to other trades. And I shall not gainsay that many required confidence. For, as Dr. Oliver Wendell Holmes told Harvard's first dental graduates, yours is "a profession in whose presence kings are silent, at whose command eloquence is struck dumb, and even the irresistible and irrepressible voice of woman is hushed in a brief interval of repose."

The physician, of course, in using the historical allusion was wont to ignore the fact that medicine, too, was once a child. Paul Revere and the Egyptians may have built their bridges with no thought of pathology. They may not have understood the problem of decay or the minute organisms that are the parents of infection; but neither did the doctors of the day whose work as physicians had but recently been divorced from other trades. "In King Richard the Second's time, physicians and divines were not distinct professions," said that same John Ward. It had been but a century or so before Revere that the physician and the barber went different but equally unscientific ways. The man who inserted an inlay without thought of an abscess was little different from the man who sutured a wound without knowledge of microbes. If John Greenwood, who constructed the

(Read at the Second General Meeting of the Seventy-Ninth Annual Session of the American Dental Association, Atlantic City, N. J., July 13, 1937.)

ivory, spring-controlled teeth of George Washington, was only an artificer, the doctors who bled him repeatedly till the "blood came slow and thick" leave even less for the admiration of posterity. Yes, if dentistry rode with Paul Revere in the past, the candid reader cannot escape the fact that medicine rode frequently with the fourth horseman.

But I did not come to discuss history. Both medicine and dentistry are emerging from a past which, while earnest and honorable, was frequently unscientific. Even now, we have done little more than scratch the surface of potential knowledge. There is much unfinished business in our sciences if we are to prolong life, to promote health and to add to the total of human happiness and prosperity. Our emphasis is shifting from cure, from alleviation of symptoms to prevention.

Diseases of the teeth present one of the most promising fields for a program of prevention. It has been estimated that but a quarter of our population now receive adequate dental care. Tooth ailments are next only to the common cold as the most frequent of our ills.

Dentists over a period of two decades have most effectively impressed their patients with the need for regular care. The American who does not have his dental examination two or three times a year is apologetic; whereas, the American who never has a thorough general physicial examination all too frequently regards his lapse from medical observation as a sign of masculinity or strength.

You have, without doubt, a strong cosmetic urge as your ally in interesting the public in teeth. "There is no pearl in any royal crown for which a young queen would give one of her front incisors," said Holmes. It is an advantage in propaganda the physician does not have. If our hearts were, indeed, worn on our sleeves, one may suppose that heart disease would appear earlier for diagnosis. But whatever the reason for public consciousness of teeth, the result is there. Your patients come back. Your profession recognizes a responsibility on the part of the practitioner to invite them to the periodic examination.

RELATION OF THE PUBLIC HEALTH SERVICE TO DENTISTRY

The work of the United States Public Health Service with relation to dentistry falls into a natural trichotomy. There is first the clinical work, the furnishing of dental service. There is, secondly, the public health work, the development of a program which will reduce the incidence of dental disease and bring existing dental disease to diagnosis and treatment. There is, finally, the extension of our knowledge of dental ill health through scientific research. I shall consider them successively.

TREATMENT

Treatment is furnished only to beneficiaries of the United States Public Health Service. This includes merchant seamen, and the Coast Guard, who have been medical charges of the Service since its establishment in 1798. It includes lepers, those held at immigrant stations, inmates of federal penitentiaries and a few special groups. Full-time officers of the Service gave 698,743 treatments to 173,271 patients during the year 1936. We have taken the attitude that care of the patients in our charge involves skilled dental care no less than competent diagnosis and treatment are required in the other specialties of medicine.

PUBLIC HEALTH

One could not epitomize the change that has taken place in dentistry during the past sixty-five years more succinctly than by contrasting that previously cited Harvard commencement address of Dr. Holmes with the discussion in the dental journals today. It was the mechanical wonders of replacement that enraptured the dentist in 1872. He drew an urbane contrast between the *rateliers* of the French and the "mineral teeth" which

America had brought to "greatest perfection." "There are nine factories engaged in their fabrication," he boasted. "Compare the delicately tinted, exquisitely shaped porcelain incisors with those frightful palisades that used to play up and down like a portcullis in a manner terrifying to all beholders."

The modern emphasis on saving teeth, the fact that teeth have utilitarian uses essential to the health and happiness of the human animal, is hinted at only one point. Holmes quoted the sad complaint of Walter Savage Landor: "I have lost my mind," cried the poet; "that I do not care so much about; but I have lost my teeth and I cannot eat."

Today, dentists fight to save teeth and to develop sound teeth. Health departments and school health services are organized to ascertain the condition of children's teeth and to give them prophylactic care. Industrial medical services find that a dental clinic pays dividends in time saved and in increased efficiency. Not cosmetics, but economics has presented its brief for better dental care.

It was the Social Security program which crystallized our economic interest in the public health. One must go back a little in history to trace that development. When the President appointed a committee to consider ways and means of minimizing social insecurity, it was evident that the problem of preventable unemployment and preventable disability due to disease were keys to the ultimate stability of the program.

The late Edgar Sydenstricker headed the technical committee which dealt with medical care. Any national program of health security, he declared, should emphasize prevention of disease, and prevention should take precedence over any efforts to distribute the costs of sickness or its consequences.

From his recommendations grew those provisions of the act which relate to public health. An appropriation of $8,000,000 a year was provided to assist states and counties and other political subdivisions in establishing and maintaining adequate public health services, including the training of personnel. These funds are distributed among the states on a threefold basis: The population of the states, the special health problems of the state and the financial needs and resources. An additional $2,000,000 was authorized to extend the research work of the Public Health Service.

The precise programs in each state are not under any authoritative control of the United States Public Health Service or any federal agency. The act provides that before the regulations are issued governing the state allotments, conferences should be held with the states and territorial health officers. These regulations apply with equal force to the dental public health program and to all other public health developments under the act. The first conference of state health officers in 1935 drew up regulations as to the purposes for which such funds might be expended.

As I see it, the United States Public Health Service can exercise its best influence over this development by acting as a catalytic agent, bringing together, stimulating into action, local public and private agencies throughout the land. It can report facts; it can synthesize the work of others; it can operate the lighthouse on which local public health navigation must depend. I would dwell briefly on some of our recent work.

Foremost, perhaps, is the work of oral health education. Dr. Frank C. Cady, dental surgeon of the Service, has recently prepared an outline of procedures in this field for the assistance of health officers and local groups. These are the principles which he emphasizes: That the dentist administering this activity for the health department have graduate training in public health methods; that his work shall be directed toward stimulating and coordinating the work of all agencies and individuals concerned: the dental profession,

the medical profession, public health nurses, school teachers and those who will benefit from the program: the pre-school children, the school children and the adults of the community.

There are two points which are emphasized in the contemplation of the Social Security Act. One is the local control over the development of the program. The other is that personnel shall be trained and high professional standards be maintained in order that local control may be thoroughly effective. In dealing with all groups who work under the Act, the Public Health Service seeks to develop the technics that will insure the success of that local control, and thus cooperation with the dental societies and the medical societies in coordinating the work is urged in considerable detail.

In every state health department, there should be a dental division, and this division should be charged with responsibility for developing this program. That was the recommendation of the Conference of Local and State Health Officers. Many states have established such offices. To meet the need for trained personnel, short intensive courses are being set up to train health officers, nurses and other personnel in the problems of the new program. Certain schools were designated as regional training centers by a majority vote of state health officers. They were selected for their special facilities for dealing with public health matters.

The ultimate success of training and planning, however, must rest upon the completeness of our facts. Measurement must precede the draftsman's pen. As to dental needs, we have such facts. Last year, the Public Health Service published a dental survey of school children, ages six to fourteen years, made in 1933-1934 under the direction of the late Dr. C. T. Messner. Data for tabulation were contributed by more than 8,000 practicing dentists in twenty-six states.

The published report of Dr. Messner's survey is no light reading. It is nothing to read in the nonchalant comfort of a lounge chair. Of its 248 pages, 277 are the tabulated record of the findings of the 8,000 of your colleagues who examined the teeth of the school children in the twenty-six states surveyed. It is a record of dental caries in American school children, of gingivitis, of extractions needed, of malocclusion. With its figures—and you can request it as Public Health Bulletin No. 226—this survey provides state health authorities and your local societies with the ammunition for a campaign for better dental care. You will find it there county by county and town by town as a factual basis for needed action.

RESEARCH

Salient in the fight against dental disease is the third field of our concern, research. We must discover the causes of dental caries, we must find the factors in building sound and regular teeth and the things which will inhibit diseases of the teeth. Research has all too often been given over to the great dramatic things which kill and maim a few, while the things which sap the vitality of the million are ignored.

As a consequence, tooth diseases which are merely common are not so well understood as they must be if we are to make real progress in reducing their incidence. It is in the field of research that the Public Health Service can contribute a great deal to the dental profession. In research and as a clearing house for research, the Service makes one of its greatest contributions.

One such project has already progressed to the point where it has produced results. You are, no doubt, familiar with the studies which H. Trendley Dean, dental surgeon, has conducted in the problem of mottled enamel. The Service published in 1933 his study on the distribution of mottled enamel in the United States, which localized sixty-seven areas of high prevalence. The following year a report of laboratory experiments which showed the

effect of ingestion of various amounts of sodium fluoride on the teeth of white rats was published. Studies since that time in the special area of Texas and in the minimal threshold of mottled enamel have added to the accuracy of our knowledge. These and the various experiments in the field of nutrition suggest that dental research may open new vistas in the chemical interpretation of human ills.

There is one point to which I think your profession and this association should direct special attention. That is the funds for research. The amount of research which may be done will be limited, is bound to be limited, by the funds which are available. For dental diseases which are persistent rather than deadly, appropriating bodies have not always seen the wisdom of supplying funds for research. I hope it will be possible for the United States Public Health Service to extend its work with your research committees in stimulating and assisting research in universities and scientific institutions.

We need, then, to extend our knowledge of the factors which make for dental health. Hand in hand with this search for new knowledge must go the better application of present knowledge, first to prevent disease, and secondly to give needed care and treatment to all groups of the population. Each dentist needs to concern himself not only with the dental needs of the individual patient, but also with the dental needs of the whole community.

Dentistry of today differs a great deal from that of Paul Revere's day. Scientifically it has evolved as the result of successive accretions to knowledge. In its practice, it has evolved to meet the changing needs of society. Medical and dental practice will continue to evolve. Sound progress in the human relations of professional practice has always been an evolutionary process.

I do not foresee or fear any radical change in the methods of medical or dental practice in this country if our professions recognize the needs of the people for medical and dental care and take the necessary steps to meet those needs. This, in my opinion, will necessitate a closer partnership between the public health agencies, the research institutions and the professions themselves.

Governments everywhere have accepted new responsibilities for their indigent and for those whose low incomes make them medically indigent. The necessities of life, food, shelter and clothing, have been an old concern of rulers; but, under democratic governments, this concern is not considered largesse: it has been assumed as a responsibility. Similarly, society accepts medical and dental care as one of the necessities of life.

All of our plans for medical and dental care in the future must take into account the inherent right of every citizen to be able to secure the services which science has made it possible for our professions to give. In recent years, public funds have been used increasingly to provide not only for the prevention of disease, but also for the care of those unable to provide service for themselves. I hope the public continues to accept an increasing share of responsibility for our underprivileged groups.

Responsibility for health, under our form of government, is shouldered primarily by each community. How much of the burden should fall on the federal government and the state is a problem which must yield to the judgment of experience. There must be minimum standards of medical and dental care. In arresting disease, including dental diseases, and in preventing the development of disease, society assumes an obligation which will pay dividends in the conservation of human resources.

In my opinion, the necessary medical and dental services of the country can be furnished to the people without a federalized system of medical or dental practice. The first interest of the Public Health Service is to prevent disease, whether physical, mental or dental. Dur-

ing the past fifty years, we have worked out sound methods of cooperating with the states in the development of their health programs. This cooperation has not entailed a centralization of authority. The principle of grants-in-aid for public health under the Social Security Act in itself represents merely an extension of the traditional federal-state relationships in which there is a maximum of community responsibility, the maximum of local direction for health programs which meet minimum standards applied by the federal government but created by the states.

In working out this whole program of research, of prevention, better service for all, we need the full cooperation and leadership of the dental profession through your national, state and local associations.

I close with a paragraph from Rosenau:

Preventive medicine dreams of a time when there shall be enough for all, and every man shall bear his share of labor in accordance with his ability, and every man shall possess sufficient for the needs of his body and the demands of health. These things he shall have as a matter of justice and not of charity. Preventive medicine dreams of a time when there shall be no unnecessary suffering and no premature deaths; when the welfare of the people shall be our highest concern; when humanity and mercy shall replace greed and selfishness; and it dreams that all these things will be accomplished through the wisdom of man. Preventive medicine dreams of these things, not with the hope that we, individually, may participate in them, but with the joy that we may aid in their coming to those who shall live after us. When young men have vision the dreams of old men come true.

GOLD FOIL AND PLATINUM-CENTERED GOLD FOIL; METHODS OF CONDENSATION

A REPORT OF CONTINUED INVESTIGATIONS†

By R. W. Rule,* D.D.S., San Francisco, Calif.

SINCE the report of a year ago,[1] published in April of this year, this investigation has been carried on, primarily with a view to checking the results of work with heavier platinum-centered gold foil as suggested in the earlier report. In addition to this, a further check has been made on the different methods of condensation. Special interest in the latter was promoted by the invention of a pneumatic condenser, which was called to my attention in November of last year and which seemed worthy of careful consideration.

The time that it was possible to devote to this work during a busy year has not been sufficient to make the investigation as complete as one would like, but the results have been convincing, at least to the mind of the investigator.

Only such reference will be made to the earlier report as is necessary for comparisons.

The same split steel die was used for the test specimens, and, in addition, cavities of approximately the same dimensions as

*Author's note—This paper should be read in connection with the report published in The Journal, April 1937, p. 583.

†Contribution from the Division of Operative Dentistry in conjunction with the Division of Physical Sciences, College of Dentistry, University of California.

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those of the steel die were cut in "ivorine" teeth in "dentiforms" mounted with a bench clamp and a supporting rod having considerable "give" or spring to it, so that the filling conditions were as nearly similar to mouth conditions as possible.

Five types of condensation were used: the hand mallet, with an assistant; the automatic mallet; an engine mallet, the Bonwill mallet and the pneumatic mallet. A 4x9-3-3 parallelogram condenser point was used throughout.

The materials used were No. 4 soft pure gold, and platinum-centered gold foils of Nos. 4, 8, 12 and 40, with 30 per cent platinum, and No. 8, with 16 per cent platinum. These numbers as designating the thickness of the foil are not entirely accurate, but as nearly so as such materials usually come. In preparing new materials, as all of these were except the No. 4, the manufacturer no doubt requires some experience to reach a standard. One of the manufacturers, evidently through a misunderstanding, sent samples of 30 per cent platinum foil of approximately Nos. 12 and 40 instead of No. 8. These were used along with the others to shed what light they might on the subject.

Forty-eight specimens are reported. Twenty of these are of pure gold and twenty-eight of platinum-centered gold. Five of the pure gold specimens were made in the steel die with the pneumatic mallet. Fifteen of pure gold were made in ivorine teeth; and, of these, two were made with the hand mallet, three with the automatic mallet, two with the engine mallet, two with the Bonwill and six with the pneumatic mallet.

Of the twenty-eight specimens with platinum content, one is No. 4, 15 per cent; three are No. 4, 30 per cent; ten are No. 8, 30 per cent; seven are No. 12, 30 per cent; two are No. 40, 30 per cent; and five are No. 8, 16 per cent. All but two of these were made in the steel die, two with the hand mallet, none with the automatic mallet, three with the engine mallet, four with the Bonwill and nineteen with the pneumatic mallet.

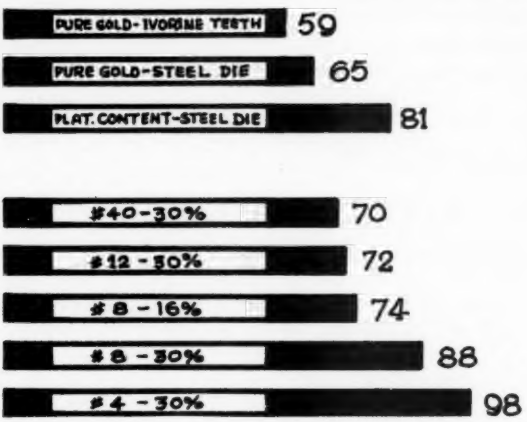

Fig. 1.—Brinell hardness.

Density and elongation tests were omitted in this series, since it was believed that the earlier tests had established all that could be expected from them.

In each table, the specimens are again arranged in the order of Brinell hardness. A column is introduced giving the size of the pellets, since this proved to be significant. The sizes are given in fractions of grains and are approximately, but not entirely, accurate. These pellets were hand

made in cylindrical form, conforming to the rectangular cavity shape.

The 9x4-3-3 parallelogram condenser point was used throughout because it seemed from the earlier tests to be the most practical point to use. It is quite likely that a 5 by 10 point could be used satisfactorily with the pneumatic mallet in extensive restorations.

The principal correlations to be made from this series of tests are those of the Brinell hardness, tensile strength, size of pellet used and type of condensation. The same methods were used as formerly for other series made under comparable conditions; *i. e.*, a Brinell hardness of 64 as compared to 54. The tensile strength of these specimens averaged 45,000 pounds per square inch as compared to 38,000 in the others.

Table 2 gives data on thirteen specimens of pure gold made in cavities cut in ivorine teeth. It is believed that there would be little difficulty in obtaining as great density, hardness and tensile strength in restorations in bicuspids and molars in the mouth as were obtained in this series of specimens. An effort was

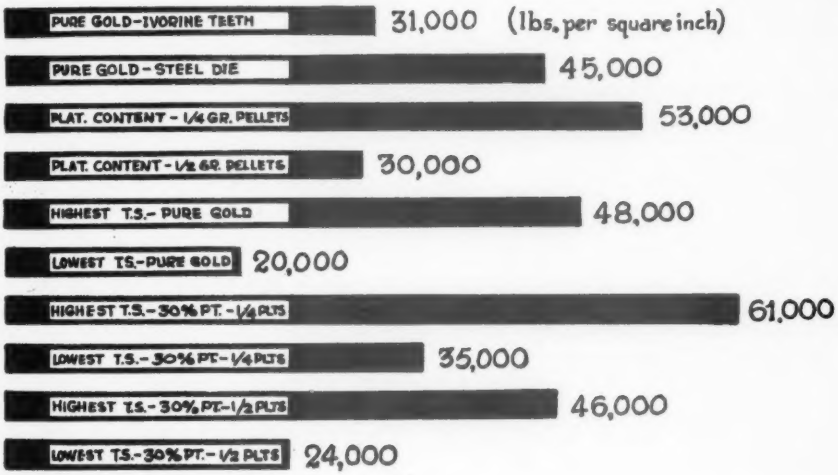

Fig. 2.—Tensile strength.

determining the Brinell hardness and the tensile strength. Some tests were also made of the comparative hardness with and without burnishing.

Table 1 gives data on five pure gold specimens made in the steel die, all of them with the pneumatic condenser. This work was chiefly a test of the new mallet in comparison with earlier work done with other mallets. The five specimens show hardness slightly above the top five specimens in the earlier tests and an average ten points higher than the average of the made to use no greater force nor any different technic than one would use for work in the mouth.

Black, in discussing "The Nature of Blows and the Relation of Sizes of Plugger Points to Force as Used in Filling Teeth," states[2]:

> In considering the effect of blows there are four elements: (1) weight of the mallet; (2) velocity of the mallet; (3) the character of the resistance. Upon these three the pounds force of the blow is determined. (4) Area of surface over which the effect of the

blow is expended is a secondary but important factor in determining the work done by the blow upon any substance struck. In this we reckon the force per square millimeter.

In filling teeth we depend upon the force of the blow at the moment of contact. In order to produce the results desired, blows must be carefully fitted to the conditions and the work to be done. They must not be too strong nor too light or they will fail to fulfill the purpose intended. In each case the area of the plugger point must be fitted to the pounds pressure of the blow. The instrument we use, and which receives and transmits the blow of the mallet, communicates the accumulated force of the mallet, less the retarding power of its own weight, to the condensation of the gold. It is the stress between the instrument point and the gold that we employ.

on a solid bench, (2) the steel die resting on a less solid table with a folded towel or small cushion under it, (3) the ivorine tooth so mounted that there is less resistance under the force of the blow and (4) the varying conditions in the mouth, as in the case of long roots well supported or short roots and perhaps a weakened paradentium.

The figures given in Table 2, for the specimens in ivorine teeth, show a surprisingly high Brinell hardness, since the average is 59, only five points below the average in Table 1, the specimens in the steel die, and still above the pure gold specimens of the earlier report. Thus, the pneumatic mallet is seen again, as in

TABLE 1.—DATA ON PURE GOLD SPECIMENS MADE IN SPLIT STEEL DIE*

Specimen	Manufacturer	Brinell No.	Tensile Strength in Pounds per Square Inch	Time Minutes
N-1	P	72	47,000	40
N-2	O	67	40,000	40
O-1	R	64	41,000	60
N-3	Q	62	48,000	50
N-4	Q	59	48,000	45

*No. 4 soft pure gold was used, in one-fourth grain pellets, and condensation was carried out by use of a pneumatic mallet.

In my earlier report,[1] Black's fourth point above, relating to the area of the surface over which the effect of the blows is expended, is brought before us again in a practical way in the effect that the area of the condenser point is shown to have on the hardness and tensile strength. His third point, the character of the resistance, was especially in mind in the series of tests for which figures are given in Table 2, and is also illustrated quite forcibly in another way in the figures given in Table 3, by the effect that the size of the pellets has on the results obtained. This will be discussed later.

It will be easily understood that the character of the resistance is quite different in the case of (1) the steel die resting

Table 1, to bring up the average in hardness. The tensile strength drops down somewhat, to 31,000 pounds per square inch. If to these are added the figures of specimens X-3 and X-4 in Table 4, the change is so slight as to be of no significance. Whether there is some other determining factor here, such as the weakening of certain specimens in preparing them for the test or an imperfect alinement in setting the specimen in the testing machine, causing a slight bending under tension and thus weakening the specimen, I am unable to say. The latter would have more of an effect on the platinum content specimens because of their greater brittleness. It is my belief that this did occur in a few of the specimens,

bringing down the average of the tensile strength figures. Specimen O-2, which had a Brinell number of 102, received a jar which caused a definite bend, and when it straightened out under tension, it gave way at 30,000 pounds per square inch. The longer end of this specimen was again prepared for testing and gave way at 59,000 pounds per square inch.

Table 3 gives data on twenty-six specimens with platinum content made in the steel die. A study of these figures brings out some interesting points. The averages of Brinell hardness and tensile strength are comparable to those of the earlier investigation, if other factors introduced into this series, notably size of pellet and kind of material, are considered. The average Brinell hardness of all platinum content specimens made in the steel die is 81, and the average tensile strength is 44,000 pounds per square inch.

It will be observed in the "time" column that some of the figures are quite a little higher than others. This is largely due to the fact that many of the specimens were made without an assistant to anneal and pass the gold. Leaving out the automatic mallet, which was very slow, and the Bonwill, which was very fast, the average time for those made without an assistant was forty-two minutes; whereas that for the specimens with an assistant was thirty-one minutes. Because of this time factor, the size of the pellets was doubled, with the idea of reducing the number of interruptions for annealing, and with no anticipation that the work might be affected in some other way. Soon it was noticed that the hardness figures were dropping and an effort was made to determine why. A record was kept of the size of the pellets used in each specimen and, in the final analysis, by segregating the specimens made with one-quarter grain pellets from those made with one-half grain pellets, we find that the smaller pellet specimens have an average hardness of 84 as compared to 70 for the others, while the tensile strength is 53,000 as compared to 30,000. It should be stated that the specimens made with the Bonwill mallet were omitted from this reckoning, since the long stroke and heavy blow of this mallet seemed largely to overcome the effect of using large pellets.

This difference attributable to pellet size is significant, since it illustrates, as already said, another phase of the ques-

TABLE 2.—DATA ON PURE GOLD SPECIMENS MADE IN "IVORINE" TEETH*

Specimen	Manufacturer	Brinell No.	Tensile Strength in Pounds per Square Inch	Time Minutes	Pellets Grains	Type of Mallet
O-3	O	68	30,000	..	¼	Pneumatic
R-4	R	67	41,000	30	¼	Pneumatic
Q-1	O	66	53,000	25	¼	Engine
R-3	O	64	32,000	45	½ & ¼	Automatic
Q-3	O	63	27,000	25	¼	Engine
P-2	O	61	41,000	..	¼	Pneumatic
R-1	O	61	29,000	25	¼	Bonwill
R-2	O	61	28,000	25	¼	Bonwill
P-3	O	58	32,000	55	¼	Automatic
P-1	O	55	38,000	30	¼	Pneumatic
Q-2	O	52	.....	30	¼	Hand
Q-4	O	47	25,000	35	¼	Hand
P-4	O	42	20,000	55	¼	Automatic

*No. 4 soft pure gold was used.

tion of "the character of the resistance" mentioned by Black, and is a factor to be reckoned with in our work at the chair. One-half grain pellets are about the largest size ever used for practical work with cohesive gold, and it is evident that unless spread out evenly over a large surface, they will tend to weaken the results of the work. One-eighth and one-quarter grain pellets seem to be the most practical sizes for general use, and even smaller pellets may be desirable in certain small cavities.

Doubtless for similar reasons, it may be said, in a general way, that the heavier foils produced the softer specimens, though increasing the tensile strength except where the large pellets were used, and then the tensile strength dropped considerably. In working with the heavier foils, especially the No. 8-30 per cent platinum, I was somewhat surprised that the hardness figures were not higher, so, in order to check back, several specimens were made with the No. 4-30 per cent platinum and the Brinell hardness was again brought up to the earlier figures. Considering only the 30 per cent platinum, made with one-quarter grain pellets, the No. 4 gave a hardness average of 98; the No. 8, an average of 88, and the No. 12, an average of 71. The No. 8-30 per cent platinum made with one-quarter grain pellets averaged over 53,000 pounds per square inch in tensile strength, as compared with 50,000 for specimens in the first series made with No. 4-30 and 40 per cent platinum.

This leads us to a consideration of my recommendation to the manufacturers in the earlier report, that the platinum-centered foils be made somewhat heavier to

TABLE 3.—DATA ON GOLD AND PLATINUM SPECIMENS MADE IN STEEL DIE

Specimen	Manufacturer	Material Platinum	Brinell No.	Tensile Strength in Pounds per Square Inch	Time Minutes	Size of Pellets Grains	Type of Mallet
O-2	R	No. 4-30%	102	59,000	60	¼	Pneumatic
W-4	M & R	Nos. 8 & 4-30%	99	42,000	45	½ & ¼	Pneumatic
M-4	M	No. 8-30%	98	60,000	40	¼	Pneumatic
M-1	M	No. 8-30%	97	61,000	20	¼	Bonwill
M-3	M	No. 8-30%	96	51,000	40	¼	Pneumatic
V-4	R	No. 4-30%	92	35,000	45	¼	Pneumatic
W-1	M	No. 8-30%	92	58,000	45	¼	Pneumatic
V-1	M	No. 8-30%	89	53,000	60	¼	Pneumatic
M-2	M	No. 8-30%	87	50,000	..	¼	Pneumatic
T-1	R	No. 12-30%	87	46,000	17	½	Bonwill
V-3	M	No. 8-30%	86	40,000	20	½	Bonwill
W-2	M	No. 8-30%	85	49,000	35	¼	Pneumatic
S-1	O	No. 8-16%	81	46,000	17	½	Bonwill
W-3	M	No. 8-30%	80	51,000	40	¼	Pneumatic
T-4	R	No. 12-30%	78	29,000	25	½	Pneumatic
U-3	R	No. 12-30%	75	45,000	32	¼	Pneumatic
S-4	O	No. 8-16%	73	34,000	20	½	Hand
S-3	O	No. 8-16%	73	26,000	25	½	Pneumatic
U-2	R	No. 12-30%	72	42,000	30	½	Pneumatic
S-2	O	No. 8-16%	70	42,000	26	½ & ¼	Engine
O-4	R	No. 40-30%	70	40,000	..	¼	Pneumatic
U-1	R	No. 40-30%	70	40,000	25	¼	Pneumatic
T-3	R	No. 12-30%	70	24,000	23	½	Hand
V-2	M	No. 8-30%	70	48,000	30	¼	Pneumatic
U-4	R	No. 12-30%	68	48,000	35	¼	Engine
T-2	R	No. 12-30%	55	28,000	20	½	Engine

overcome the tendency of the pure gold to burn off the platinum during annealing. No. 6 was suggested. The entire effect of this was not foreseen. A greater tensile strength was expected and this expectation seems to have been justified. The annealing difficulty seems also to have been overcome, although all of the foils supplied were heavier than No. 6, the lightest being a little over No. 7 and, for uniformity, listed in this report as No. 8. The decrease in hardness from the use of heavier foil was not anticipated, and as hardness as well as strength is desired in this material, this must be considered. It remains to be seen whether a No. 6 foil will give the desired hardness and strength and still answer the annealing requirements.* In handling the No. 8 foil, it was noticeable that the bright gold color was retained in the annealing unless the foil was held too long in the flame, and also that, in the tensile strength tests, there was a clean break without the zigzagging and apparent weakness of cohesion which showed in some of the No. 4 specimens of the earlier report.

After considering the material of Tables 1, 2 and 3, it seemed desirable to check up on the material of Table 2, and perhaps to include one or two platinum content specimens, so another series of four cavities was cut in ivorine teeth, one specimen of No. 8-16 per cent platinum, another of No. 4-15 per cent platinum and two of No. 4 pure gold being made, all of one-quarter grain pellets and with the pneumatic mallet.

This series was carried through very carefully as to all details of technic and the results are so nearly similar to those given in Tables 2 and 3 that further comment on them seems unnecessary.

Figure 1 is a graph showing the averages of groups of specimens made under varying conditions, with their comparative Brinell hardness. The pure gold specimens made in ivorine teeth averaged 59 as compared to 65 for those made in the steel die and 81 for those with platinum content made in the steel die. The latter group was affected by two factors not entering into the study of the pure gold specimens: the size of the pellets and the thickness of the foil. The effect of the thickness of the foil is graphically shown, beginning with Brinell number 70 for No. 40 foil and gradually going up to 98 as the thickness reduces to that of No. 4.

Figure 2 is a graph giving tensile strength comparisons. Pure gold specimens made in ivorine teeth are seen to average 31,000 pounds per square inch as compared to 45,000 for those made in the steel die. Platinum content specimens made with one-quarter grain pellets average 53,000 as compared to 30,000 for those made with one-half grain pellets. The highest tensile strength for pure gold was 48,000, the lowest 20,000. The highest tensile strength for 30 per cent plati-

TABLE 4.—DATA ON FOUR CHECK SPECIMENS IN "IVORINE" TEETH*

Specimen	Manufacturer	Material	Brinell No.	Tensile Strength in Pounds per Square Inch
X-1	O	No. 8–16% Platinum	74	45,000
X-2	M	No. 4–15% Platinum	74	44,000
X-3	O	No. 4 Soft Pure Gold	61	38,000
X-4	O	No. 4 Soft Pure Gold	61	33,000

*The time was forty minutes; size of pellets, one-fourth grain. A pneumatic mallet was used for condensation.

*Since the foregoing was written, No. 6 foil, 30 per cent platinum, has been tested and found satisfactory in every respect.

num made with one-quarter grain pellets was 61,000, the lowest, 35,000. The highest tensile strength for 30 per cent platinum specimens made with one-half grain pellets was 46,000, the lowest 24,000.

EFFECT OF BURNISHING

Beginning with Series Q, a test was made, with twenty-eight specimens in all, of the effect of burnishing on Brinell hardness. After the specimens had been malleted, one-half of the length of 10 mm. was burnished and the other half left unburnished. Hardness tests of five spots at each end were made, with the result that the burnished ends averaged 4¼ points higher than the unburnished ends.

Since burnishing had been done on all other specimens, the Brinell numbers given in the tables of this series are those of the burnished ends.

MEANS OF CONDENSATION

The Bonwill Mallet.—This mallet has a long stroke and a heavy, rapid blow. This combination makes it very difficult to control at the enamel margins. Connected as it is to the engine arm, it is much limited as to wrist motion and tiring to use. It produces a hard and strong filling, but its disadvantages seem to outweigh its advantages.

The Engine Mallet.—This type has a short rapid stroke which is easily controlled as to force. Connected to the Dorio handpiece, it is heavy and unwieldy, causing a serious drag on the wrist and preventing delicate work.

When the mallet is used from the old cable with a No. 7 handpiece, these features are much reduced, though still objectionable. I believe that many men are still using this mallet, and it is certain that very good results can be obtained with it. It will not be the choice of young men who are being trained in dentistry today. For those who use it, it is probably more adaptable to the heavier foils, as No. 30 or 60, used in ribbon or strip form.

The Automatic Mallet.—The automatic mallet seems to have outlived its usefulness. Its one claim to usefulness in recent years has been that it can be used without an assistant. When set for a suitable blow, it is very slow and tedious, tiresome to both patient and operator. When screwed up to the last turn and used with a large point as it so often has been, it is discouragingly hard on the patient and is probably responsible for the bad name that gold foil work has in the minds of many patients and dentists, to say nothing of certain disastrous results.

The Hand Mallet.—This is used by a trained assistant, synchronizing with the operator's thrust, two blows to each thrust, and it has undoubtedly been the most favored means of condensation with a large percentage of gold foil operators for many years. Black says[3]:

> Of the different plans of applying mallet force, the hand mallet used by an assistant is by far the best, as it will produce the desired result with the least wear and tear to both patient and operator. . . . In order to condense gold well and with the least pain to the patient, the mallet force should be combined with a certain degree of hand pressure. The plugger should be placed firmly in position with such force as to bring the looser portions of gold well together and to force the tooth into a stable position in which the fibers of the peridental membrane are rendered tense, and then the blow from the mallet should follow on the instant this is done, two blows following each other in close succession. Experience has, I think, sufficiently shown that the best results are obtained by this method. . . . The sliding of the plugger point over the surface of the gold while blows are being rapidly applied, is very much more painful to the patient if the same results in condensation are accomplished. A number of machines have been devised for malleting that are very convenient in use, and yet they seem not to be much used, evidently for the reasons assigned. Among these are included the electric mallet and several mechanical devices attached to the dental engine. It is perfectly practicable, however, to make good gold fillings by any one of these plans of using

mallet force. The main questions here are as to ease and rapidity of manipulation in the first instance, and, in the second, as to comparative ease of obtaining good results.

It is evident that those groups of men who have done the most to keep gold foil work in the favor of the profession during the last thirty years are the ones who have adopted and followed the system of using the hand mallet with an assistant. The statement quoted above was made many years ago, but it probably still stands quite true with one exception: The introduction of the pneumatic mallet calls for a revision of its reference to "mechanical devices attached to the dental engine."

The Pneumatic Mallet.—Gold foil workers who have been using the hand mallet and assistant have been so convinced of the superiority of this method, and of the importance of tensing the pericemental fibers by means of hand pressure simultaneously with the delivering of the blow, that it has been difficult to attract their attention from this by either old or new devices. Innovations have had to meet rigid requirements. When the pneumatic mallet was brought to my attention, the first thing I ascertained was that the blow comes while hand pressure is being used. Of course, the hand pressure may be light or heavy, but the fact that the blow is not delivered until pressure is brought to bear and that the blows cease the instant hand pressure is released leaves the operator to use whatever hand pressure his judgment deems advisable. Moreover, the effect is very similar to that of the hand mallet force combined with hand pressure. The second point observed was the lightness of the instrument with the entire freedom from any drag or weight on the wrist, permitting the instrument to be turned or the lines of force to be changed with perfect ease. The questions then were how effective would it be and what would be the patient's reactions. Experimentally, as the figures in Tables 1 and 2 show, it tops the list in Brinell hardness and tensile strength. Clinically, it was found to do most excellent work without any unfavorable reaction from the patient. Every patient that I have asked stated that he preferred it to the hand mallet. (It should be said here that most of these were clinic patients and that the assistants were not expert with the mallet.) Thirty or more of these pneumatic mallets are now in use in our clinic. The students are highly pleased with them and are certainly getting better condensation with them than they did from their relatively unskilled efforts with the hand mallets. I am tempted to make the prediction that the pneumatic mallet is going to be a direct stimulus to gold foil work in the near future. The undergraduate students who learn their gold foil work with it will continue to use it in private practice instead of giving up the use of foil for other methods. Also, there are many men in practice who would be doing more gold foil work if they knew of a system that would enable them to get good results with greater ease.

A point much in favor of this new mallet is that, in addition to the straight instrument, there is an angle mallet which readily permits of getting correct lines of force for distal surface cavities and for cavities far back in the mouth.

RELATION OF BRINELL HARDNESS TO TENSILE STRENGTH

Camp and Francis state[4]:

It is both a curious and a significant fact that the Brinell hardness number bears a close relation to the ultimate strength, as may be seen by an inspection of the following table, which was prepared only after comparing results obtained upon thousands of specimens to which both the Brinell and pulling tests had been applied. This relation, it will be observed, is approximately 500, and holds for all grades of carbon steel whether they be heat treated or in their natural state as forged or rolled. For this reason the Brinell test is applicable to the rapid testing of steel for which samples for the tensile test cannot be obtained.

It is probably not known whether this same relation exists for such specimens as are under consideration in this paper, but it is interesting to find on computing the relation between the hardness and the tensile strength figures given in this report that it is approximately 1 to 550.*

If we may assume that the coefficient is the same for gold and platinum as for steel, the accuracy of these figures for tensile strength is within the error limit of 4,000 pounds per square inch, suggested in the earlier report. It should be remembered that these specimens are wholly dependent on cohesion for their tensile strength, and thus the figures show that the cohesion must be practically perfect.

SUMMARY AND CONCLUSIONS

Five methods of condensation have been considered. The use of the hand mallet with the aid of an assistant is given the preference over other methods except employment of the new pneumatic mallet, which seems in many ways to have the advantage.

Platinum-centered foils of varying thickness, running approximately 4, 8, 12 and 40 grains to the 4-inch square sheet, have been tested, with the result that the annealing difficulty seems to have been overcome, but it is evident that the heavier foils have a somewhat lower Brinell hardness than the No. 4. Platinum centered foil of a thickness of 6 grains to the sheet is recommended.

With the foils that are thin enough to be prepared in pellet form, the size of the pellets has a definite effect on the hardness and the tensile strength. Medium or small sized pellets give the best results.

Further experiments should be conducted to determine whether large pellets affect the results in the same way with pure gold as with platinum centered gold.

Burnishing increases the surface hardness and raises the Brinell number about four points.

The conclusions of the earlier report may stand as recorded except the one regarding the tendency of the electric or mechanical mallet to produce a filling with higher tensile strength than other means of condensation. The use of the pneumatic mallet seems now to fully measure up with the other methods in this respect and to surpass them in others.

The relation of Brinell number to tensile strength in these tests is closely comparable to the figures recorded in the literature for tests of steel.

*The author has since learned of an investigation by Coleman[5] of band and plate material made from dental gold alloys in which the relation of tensile strength to Brinell hardness was shown to range from 600 to 1 up to 740 to 1. The author's specimens made with one-fourth grain pellets range from 530 to 1 up to 706 to 1.

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TEMPERATURE CONDITIONS INDUCED DURING THE PROCESS OF VULCANIZATION*

By Horton D. Kimball, D.D.Sc., Detroit, Mich., and Floyd A. Peyton, Sc.D., Ann Arbor, Mich.

IN connection with tests relative to the physical properties of denture materials, we found it necessary to investigate thoroughly heat conditions produced within the flask during the vulcanizing or curing process.

An apparatus for studying these conditions was arranged as follows: A copper-constantan thermocouple was designed to be inserted in the vulcanizer pot. This, in turn, was connected through a cold junction to a Leeds-Northrop type K potentiometer. With this apparatus, temperature determinations were made directly within the vulcanizer during the actual vulcanizing process. (Fig. 1.)

Determinations were made according to the following outline:

1. Standardization of the thermocouple.
2. Temperature produced in different locations in a vulcanizer.
   - A. Horizontal vulcanizer.
     1. Front
     2. Center
     3. Rear
   - B. Vertical vulcanizer.
     1. Top
     2. Middle
3. Comparison of temperatures recorded by "inside" and "mercury bath" thermometers, with true temperatures determined by the thermocouple.
4. Comparison of temperatures recorded by the pressure gage with those determined by the thermocouple.
5. Effect on temperature and pressure within vulcanizer by:
   - A. Blowing off air.
   - B. Not blowing off air.
6. Temperatures produced with a flask full of plaster, during vulcanization.
7. Consideration of temperatures developed at different points within a flask during the actual curing of a denture.

PROCEDURE

The thermocouple used in these tests was first calibrated by the use of three fixed temperature points produced by pure lead, tin and distilled water. Calibration was carried out in the conventional manner described in textbooks on pyrometry. The electromotive force temperature relation for the couple was calculated from the standard equation and a curve plotted from these data. The electromotive force readings on the potentiometer were converted into temperature values from this curve.

In all tests with the vulcanizers, except where otherwise specified, the thermostat control was set at 320° F. The blow-off valve was allowed to remain open until steam issued freely, and an equilibrium was reached between the temperature indicated by the thermometer and that recorded by the thermocouple. At this time, the blow-off valve was closed, and read-

*Tests made in the Materials Testing Laboratories, University of Michigan, College of Dental Surgery.

(Data presented in the University of Michigan Educational Exhibit at the Seventy-Ninth Annual Session of the American Dental Association, Atlantic City, N. J., July 1937.)

ings were taken of the thermometer, the thermocouple and the pressure gage. Readings of these three instruments were recorded at intervals of one minute until a maximum temperature was reached and an equilibrium was once more attained between them. After an interval of equilibrium, the gas was shut off and readings were made at one-minute intervals as the vulcanizer cooled down.

Since there is a live steam atmosphere within the vulcanizing chamber, the temperature should be uniform throughout. To check this theory, the thermocouple was placed in three different locations in a horizontal vulcanizer, and temperatures were recorded while the vulcanizer was heated. Figure 2 shows a series of curves illustrating the temperatures recorded in the three different positions in the vulcanizer. It may be seen that within an experimental error of ± 2 degrees F. (1.11 degrees C.), a uniform temperature existed throughout the vulcanizing chamber.

The same experiment was then performed with a vertical vulcanizer of the compensating type. A uniform temperature was likewise found to exist throughout the interior of this type of vulcanizer. This point is illustrated by the curves shown in Figure 3.

The preceding experiment provides a means also of comparing the true temperature developed inside a vulcanizer with the temperatures recorded by different types of thermometers. The thermometer on the horizontal vulcanizer extended through the door and ended in a metal cap. This is commonly referred to as an "inside thermometer." That on the vertical vulcanizer ended in a small well of mercury on the lid and is generally known as a "mercury bath" thermometer.

It will be seen in Figure 4 that neither of these thermometers records the true temperature within the vulcanizer. The inside thermometer was less in error than the mercury bath thermometer. When the inside thermometer read 320° F., the actual temperature as shown by the thermocouple was 325° F. In other words, the interior of the vulcanizer was 5 degrees F. (2.7 degrees C.) hotter than was indicated by the thermometer. When the mercury bath thermometer indicated 320° F., the actual temperature inside was 343° F. Thus, the interior was 23 degrees F. (12.7 degrees C.) hotter than was indicated by the thermometer. This variation is probably due to the fact that the metal of the lid or door radiates some of the heat away, so that a true temperature reading of the interior of the vulcanizer cannot be obtained with thermometers of this nature. The error is negligible in the case of the inside thermometer; but in the case of the mercury bath type, it is an important factor to consider. For, with the modern condensite denture materials,

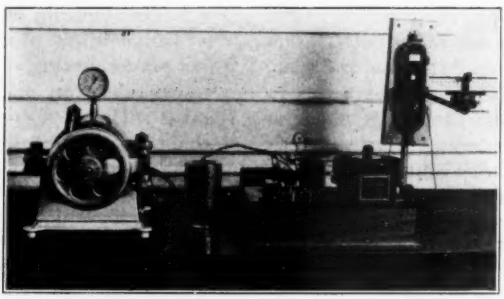

Fig. 1.—Apparatus to determine temperature conditions in vulcanizer.

temperature must be carefully watched or overcuring may result.

Another point brought out by these experiments is the comparison of the temperatures recorded by the pressure gages. As shown in Figure 5, the pressure gages checked more closely with the actual temperature than did the thermometers.

The vertical vulcanizer was next turned on and allowed to heat up without "blowing-off" the enclosed air. Temperatures within the vulcanizer were recorded by means of the thermocouple. Figure 6 presents two curves. Curve 1 is produced by not "blowing-off" the enclosed air. Curve 2 illustrates the heating curve produced when the vulcanizer is "blown off" in the standard manner. It will be seen that higher temperatures are developed within the vulcanizer when the enclosed air is blown-off.

A standard plate-flask was next filled with plaster of Paris. The thermocouple was then placed in the middle of the flask before closing, and the whole was put in the horizontal vulcanizer. The vulcanizer was then heated as before, and the rise in temperature within the flask was compared with that inside the vulcanizer pot. It should be noted here that the flask and plaster were at room temperature when placed in the vulcanizer.

Within the vulcanizer pot, the same even rise in temperature occurred that had been noted when it was heated empty. However, it was found that from five to ten minutes more was required to attain the maximum temperature under these conditions, probably owing to the bulk of the enclosed flask. It was further observed that a uniform rise of temperature occurred within the flask itself until a temperature of approximately 230° F. was reached. At this point, the temperature rise slowed up very markedly for a period of fifteen minutes, during which time there was a rise in temperature of but 20 degrees F. This pause is thought to occur at the point where some of the water of crystallization is driven from the plaster.

It is of interest to note that during this fifteen-minute lag, from 240° to 260° F., a decided weakening takes place in the strength of the plaster. This phenomenon has been treated in detail by one of us in a previous report.[1]

After the "lag," the temperature again rises rapidly until the maximum temperature is attained. This maximum temperature was found to be the same as that within the vulcanizer pot. In other words, the interior of the flask of plaster ultimately comes to exactly the same temperature as the vulcanizer pot itself.

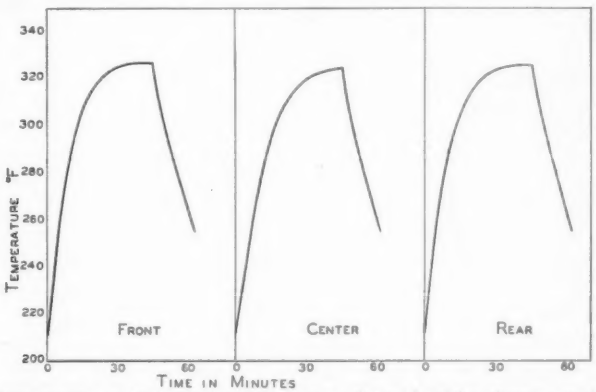

Fig. 2.—Temperature in horizontal vulcanizer, as determined by thermocouple; showing its uniformity throughout entire vulcanizing chamber.

This experiment was then repeated with a vulcanite base-plate placed within the flask. Results were similar to those already described, indicating that vulcanite itself has no appreciable effect on the heating rate.

Again, the experiment was repeated with a vulcanite base-plate within the flask. This time, the flask of plaster and vulcanite was boiled for an hour before being inserted in the vulcanizer. It was found that, with the original or starting temperature higher, slightly less time was required to attain the maximum temperature than when the flask was started at room temperature. The same "lag" was found to occur, although it appeared approximately ten minutes earlier.

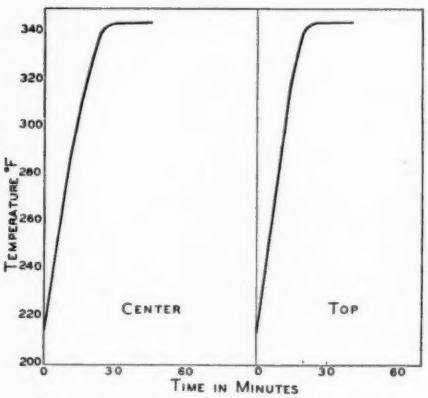

Fig. 3.—Temperature in top and center of vertical vulcanizer, as determined by thermocouple. There is uniformity of temperature throughout vulcanizing chamber.

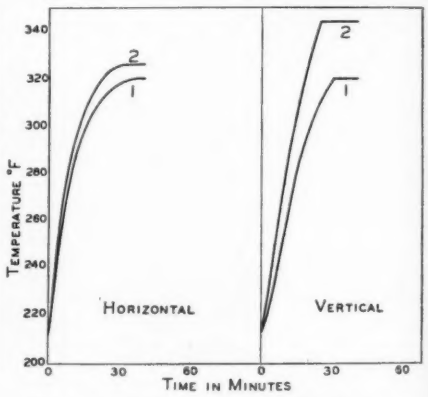

Fig. 4.—Temperature by thermometer versus temperature by thermocouple. Curves 1 were determined by thermometers; curves 2, by thermocouple. There are errors in both thermometers, the "mercury-bath" thermometer of the vertical vulcanizer having much greater "error" than the "inside" thermometer of the horizontal vulcanizer.

Despite the fact that the heated flask attained the maximum temperature about ten minutes earlier than the cold one, it is questionable that much is to be gained by the practice of vulcanizing denture cases immediately after packing them, and while the flasks are still warm. Neither should it be necessary to prolong the cure to any extent if the flasks should be cold at the time of vulcanization.

Figure 7 shows three curves which illustrate the experiments just described. Curve 1 is the normal heating curve within the vulcanizer itself, 2 shows the heat rise within the cold flask and 3 illustrates the rise of heat within the flask which had been boiled. The temperature lag is clearly illustrated by Curves 2 and 3, which show the temperature rise within the plate flasks.

One important fact should be stressed at this time in regard to the length of cure of vulcanite. If the curves in Figure 7 are studied, it will be seen that the interior of a flask containing a denture requires over thirty minutes longer to attain the maximum temperature than does the interior of the vulcanizer itself. This should be borne in mind in the vulcanization of a practical case. To illustrate: The average practitioner or dental laboratory frequently will use a cure of 320° F. for one hour as a standard cure of a vulcanite denture. The cure is timed from the moment the desired temperature is indicated by the thermometer on the vulcanizer. It is shown in Figure 7 that an additional

thirty minutes is required to heat the interior of the flask to 320° F. Therefore, a case which the dentist believes to be cured for one hour at 320° F. is in reality vulcanized at this temperature for only thirty minutes.

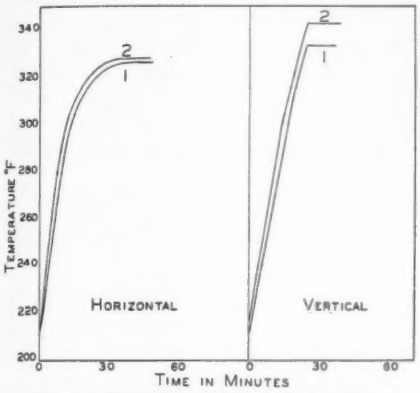

Fig. 5.—Temperature by pressure gage versus temperature by thermocouple. Curves 1 are pressure gage curves; curves 2 are determined by thermocouple. The pressure gage readings are more accurate than thermometer determinations shown in Figure 4.

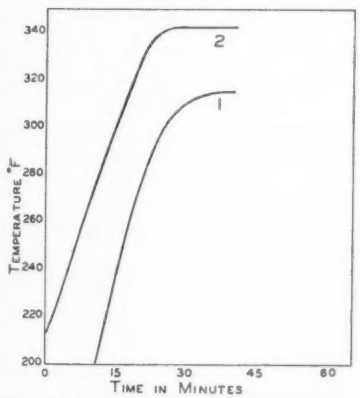

Fig. 6.—Comparison of temperatures (by thermocouple measurement), produced by: not blowing off air (curve 1) and by blowing off air in usual manner (curve 2). Higher temperature is induced when the air is blown off.

Such a cure is too short, particularly for vulcanites containing a high degree of pure rubber, such as the dark elastic, gold-base and English-base types. At least another thirty minutes should be added to the vulcanization time, and a stronger rubber will result. These facts relative to time and temperature factors during curing are brought out conclusively in a previous report[2] in which one type of vulcanite was subjected to one-hour, two-hour and three-hour cures at 320° F. and the differences in strength were recorded.

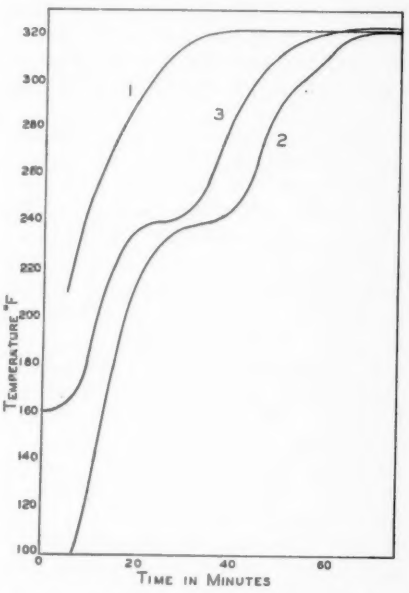

Fig. 7.—Curves showing heating rate of hot and cold flasks of plaster. Curve 1 is the normal heating curve within the vulcanizer itself. Curve 2 shows the heat rise within the cold flask. Curve 3 shows the heat rise within the hot flask. The hot flask attains the maximum temperature approximately ten minutes earlier than the cold one. The interior of both flasks ultimately attains the same temperature as the interior of the vulcanizing chamber. There is a "lag" in heat rise from 230° to 260°, with consequent weakening of the plaster as pointed out in the previous report. Additional time (thirty minutes) is required for the interior of the flask to reach the maximum temperature after it has been attained in the vulcanizing chamber. This should be borne in mind in vulcanizing denture cases.

It is not intended at this time to enter into a discussion as to what constitutes the "best" cure for vulcanite. Work will be done on this phase of the problem and reported accordingly in the future. The point at this time is simply that an improved vulcanite will result if the one-hour cure is prolonged.

A certain amount of controversy exists at the present time as to the temperatures attained by the denture itself within the flask. It is believed by some that the periphery and the crest of the ridge are overcured, and that the area in the vault of the palate receives less heat and is undercured. There are others who believe the reverse.

With this in mind, an upper denture was flasked and packed with vulcanite. A thermocouple was placed near the crest of the ridge in the bicuspid region. The case was then vulcanized and the temperatures attained in the bicuspid area were recorded. The experiment was repeated, with the themocouple placed in the center of the palatal region.

On comparing the data obtained by the two experiments, it was found that the temperatures checked within from 3 to 4 degrees F. (± 2 degrees C.), which is believed to be well within experimental error. In other words, the temperature of the crest of the ridge and that of the vault of the palate may, for all practical purposes, be considered to be the same during vulcanization. In fact, it may be said that the temperature of the entire denture can be considered uniform during the vulcanization process. What little difference or variation in temperature may exist would be so slight as to have no effect on the quality of the "cure" in the denture and could not conceivably affect its strength.

CONCLUSIONS

1. Within the live steam atmosphere of the interior of the pot, a uniform temperature exists in all parts of the chamber. This condition holds true in both a horizontal and a vertical vulcanizer.

2. For all practical purposes, an "inside" thermometer, being but 5 degrees F. in error, is sufficiently accurate to gage the temperature within a vulcanizer. A "mercury-bath" thermometer may be as much as 20 degrees F. in error. That is, the interior of the vulcanizer is, roughly, 20 degrees F. hotter than is indicated by the thermometer. Allowance should be made for this error, especially in the cure of the modern condensite denture materials; otherwise, overcuring may result, with consequent darkening and weakening of the case.

3. Accurate pressure gages afford a more reliable means of determining the temperature within the vulcanizer than a "mercury bath" thermometer.

4. It is necessary to "blow-off" the vulcanizer in the conventional manner to attain and accurately determine the desired curing temperature.

5. The interior of a denture flask ultimately attains the same temperature as that within the vulcanizer chamber.

6. Owing to the extra time required by the interior of the flask to attain the maximum temperature, a cure of at least one and one-half hours at 320° F., or its equivalent, should be given to vulcanite, as otherwise an undercured case may result.

7. There is no necessity for vulcanizing a case immediately after packing. Room-temperature flasks will, for all practical purposes, attain a vulcanizing temperature as rapidly as warm ones.

8. For all practical purposes, the temperature of the interior of a flask during the curing process may be considered as uniform, and the denture itself may be considered as receiving a uniform cure throughout.

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ANATOMIC SPEECH DEFECTS

By Joseph M. Wepman, Ph.M., Hammond, Ind.

ONE point of variance between man and other animals is the ability to convey thoughts and feelings by word of mouth. This, in itself, is not a gift peculiar to the human race: rather, the gift is the ability to adapt the mechanism that is ours by reason of our heritage to the peculiar function of purposive sound. At birth, no one of us can speak, but by imitation, by trial and error, by desire for ease in living and by necessity, we develop the ability of creating a vibrating air stream, which when altered by oral and nasal movements, varies so like the air stream vibrations of others that we, as auditors, having these vibrations impinge on our ears, recognize this likeness and understand the desired expression of the speaker. This is speech.

Speech is the production by our vocal cords of a series of vibrations while an air stream passes them, vibrating this air stream. When altered by the various mouth positions, recognized by all of us and consciously produced in a learned order, vibration of this air stream makes purposive language. The adaptation of a group of organs and their musculature for a purpose other than their original biologic purpose is easily understood. The thorax, trachea, larynx, pharynx and the nose constitute the respiratory system. The mouth and its parts, the teeth, jaws, tongue and palates, are part of the digestive system. We have welded these two vital systems into one, not vital, but highly essential and socially useful system. This jointure has effected a machine capable of producing in its perfect state something in itself perfect and as essential to social man as any of the vital organs are to physical man.

It is a truism that the efficient functioning of any man-made machine is dependent on the condition of every part of that machine. If a unit comes from the factory incomplete in some small detail, we supply the missing part. Should an accident occur and a part be damaged, we repair the damage. Should a part deteriorate through wear or lack of attention, we replace it. So it is with the speech machine. Should an infant be born with an imperforate palate, we repair it, if possible; if not, we supply a substitute. Should an accident occur to the nose and affect its use, we straighten the offending member. Should the teeth decay or be lost owing to defect or trauma, they are replaced. The speech machine is analogous in my mind to the newspaper printing press. When we cast the type, place it in the well-oiled machine and run blank paper through it, the result is a legible printed sheet. If the type is faulty, the gears are set to run too fast, a part is missing or a wheel broken, the result is illegible or, at the very least, it is filled with typographical errors. So it is with speech. We have a thought and wish to express it. We send an even flow of air past the vocal cords, setting them and the air-stream above them in vibration. As these vibrations pass through the mouth, we form the sounds of our language by the intricate muscular manipulations necessary, and the result is speech. If, however, the soft-palate does not function, the teeth are poorly spaced or the tongue is tied, the

(From the Speech Clinic, University of Chicago.)

result is incomprehensible, or, at the very least, it is filled with errors of speech, a sound or two imperfectly made or the air stream nasalized. Good speech is the result of the proper functioning of all the parts of the speech machine.

Just what is defective speech? Any speech that is conspicuous, that is unintelligible, inaudible or confusing to its auditors; speech that is unpleasant to hear or accompanied by movements unpleasant to behold; speech that is labored and difficult for the speaker to produce; speech that is inappropriate in type or rate or degree of development—that is defective speech.[1]

There have been various attempts at classifying the defects of speech. Most satisfactory is the simple four-ply classification of Dr. Robert West at the University of Wisconsin.[1]

First are the physiologic defects, such as the speech of mongolians or cretins; second, the imitative defects, such as baby-talk; third, the psychogenic defects, such as stammering or stuttering, and fourth, the anatomic defects.

Owing to the limitations of time, our consideration will be confined to the last group, since these are defects that may most directly concern dentists in their professional capacity. These are defects in the machine itself, in the actual running gear, and defects due to faulty mechanism, the loss or decay of parts, a damaged structure.

One of the fairly common anatomic defects is the cleft-palate. This deformity, present at birth, varies in severity from the single imperforation of the hard palate to the cleft wherein the entire roof of the mouth, both hard and soft tissues, may be missing. With present-day operating technics, these conditions usually are repaired during the first years of life. Usually, the operations are successful in closing the palate, although in certain cases the opening has persisted after repeated attempts at closure. Even with the successful operation, it is usually true that, without training, the patient is still unable to effect nasopharyngeal closure, and his speech maintains most of the stigmata present in the cases of unsuccessful operation; that is, the voice remains nasal and the individual sounds requiring force in the air stream, specifically p, b, t, d, k and g, are puffs of air escaping through the nose, and those sounds requiring a well-directed stream of air become unintelligible, especially the sibilants, s, z, sh and zh.

It is likewise noticeable in these patients that the dental structures are affected and the sounds requiring normal dentures become distorted. There are cleft-palate patients with palatal structures not operated on or unsuccessfully operated on whose only correction of their physical defect is the wearing of a mechanical obdurator. These have proved satisfactory in very few cases, being awkward to use, difficult to adjust and unpleasant to wear. In speech, the obdurator usually fails as a good sounding-board for resonance and wholly fails to assist in the soft palate closure. In cleft-palate, the obdurator should be the final recourse, all other methods having failed.

Associated with cleft-palate in many instances is harelip. This defect serves to aggravate cleft-palate, affecting not only the esthetic appearance, but also the speech by malforming the lip-sounds p, b, m and w, as well as affecting the vowels o, aw and oo.

A case in point:

Case 1.—An intelligent seven-year-old girl was operated on for both cleft-palate and harelip during her first two years. Both operations were highly successful surgically. The lip repair was well done both esthetically and in restoration of function. The palate was completely closed. No attempt was made to lengthen the soft palate, although it failed of closure by over half an inch. Some slight function was present in the soft palate. The speech was untrained until this time. The speech defect was extreme. All speech was nasalized, the s, z, f, v, p, b, t, d, k, g, sh and zh. After one year of treatment, most of the

speech conditions were materially improved, except the f and v debility. The speech was less nasal. The patient was referred to an orthodontist to have the teeth straightened. Correction of this condition will permit proper forming of the sounds still affected.

An unusual but very interesting type of anatomic disorder that results in a serious speech problem is the complete removal of the larynx. Here the lungs are not in direct connection with the vibrating body or with the articulating organs of the mouth and nose. A cannula opening directly into the trachea is the means of respiration. The larynx is removed and the oropharyngeal opening is sutured. The defect of speech is its complete absence, which is due to these conditions. There are two methods available for restoration of speech:

1. The use of an artificial larynx connected at the posterior end with the cannula and by a tube at its anterior end with the mouth. The air as it passes through the trachea and the tube finds it way through the larynx and its mechanical vibrator, and this vibrating air stream passes through the rubber tube into the mouth, where the sounds are articulated normally. Various types of these larynges are in use, none of them very successful, owing to their awkwardness of use, their constant need of new parts and their difficulty of operation.

2. The use of a vicarious lung and glottis present in the normal physical make-up. Most practical and efficient of these is the one in which the esophagus is used as the vicarious lung and the sphincter controlling the mouth of the esophagus is used as the vicarious glottis.

It was my good fortune to treat such a patient in Hammond during the past year.

Case 2.—A Polish laborer, aged fifty-five, had a carcinoma of the larynx. The larynx was removed by Dr. Hugh A. Kuhn, of Hammond, in December 1935. The patient was seen after two weeks of postoperative hospitalization, and although he talked no English, the technic desired was described through an interpreter. He was taught to swallow air, and skill in this was developed by the use of a tube and bulb enabling him to force the air stream into the esophagus during the early stages of the treatment. Sodium bicarbonate was given orally to enable the patient to recognize the feeling and the sound desired by the eructation of air. He was then encouraged to "belch." After some weeks of this treatment, the "belched" air was brought under control and the plosive sounds of p and b were formed by closing the lips prior to the expulsion of air from the esophagus, storing this air within the mouth and then releasing it sharply. These two sounds were then linked with the vowels, and short words were formed during the second month of treatment. After six months, the patient was able to say twenty-four words with one intake of air. His speech sounded hoarse, but otherwise was inconspicuous.

A frequently diagnosed anatomic defect and one often blamed for many speech defects is tongue-tie. Anatomically, this is a congenital webbing between the dorsum of the tongue and the floor of the mouth and it is present in some degree in all of us. When this frenum is abnormally short, the tongue is prevented from making the movements necessary for speech. It is the unordinary tongue that is unable to touch the dental ridge or project its tip between the teeth; but when this condition does exist, the sounds affected will be the l, r, t, d and n.[2] Usually, a simple frenum-clipping operation does not remove the defect in speech, and training after the clipping is indicated. It is usually discovered after the operation that this was not the cause of the defect in speech, and speech training, which should have been considered originally, is then recommended.

An interesting case of tongue defect came to the clinic recently.

Case 3.—A four-year-old boy, one of twins, the other twin dying immediately after birth, exhibited at birth the unusual condition of the tongue adhering to the hard palate. This was clipped at four hours. Tongue movement following this operation was almost completely

uncontrolled, and another operation was performed on the frenum, at four months. The tongue is now covered with minute cysts, is rough and still lacks sufficient control for speech. The speech is almost completely nasal, although the soft palate functions; whereas those sounds made with the tongue are completely absent. The referring oral surgeon suggests another clipping of the frenum, which seems to be short, and removal of some of the tissue underlying the tongue. This will be necessary before speech training is attempted.

Probably the most common anatomic abnormality is hypertrophy of the lingual tonsil and adenoids. Many physicians will predict, from their presence, coincident with a speech defect, that they are the offenders and that their removal will correct the speech condition. This is usually not a logical diagnosis, for only one speech defect can be directly laid to the door of these organs. When adenoid tissue hypertrophies to the extent that the naso-pharyngeal opening is obstructed, the voice will lose its nasal resonance and will be defective in the same way as in a bad cold. Removal of the adenoid tissue will correct this condition. It is true, however, that certain patients will exhibit the opposite speech defect of complete nasality if the removal of the adenoid tissue leaves a soft palate which, owing to the former presence of adenoids, has lost its function or has never been used. Speech training is indicated immediately for these patients, as habits of nasality may be formed in a comparatively short time. Rarely, hypertrophied tonsils occlude the oral passageway and speech becomes very difficult. Removal of these tonsils and opening the passageway usually serves to correct the speech as well as the physical disorder.

There are other defects that are usually not discovered until after the removal of the tonsils and adenoids. These are the congenitally short palate and the mucus-covered cleft of the hard palate. It is observed that the palate is insufficient to effect the nasopharyngeal closure; whereas, prior to the operation, the action was sufficient, owing to the presence of the adenoid in the nasopharynx. The voice thus becomes nasal and the tonsil and adenoid operation is rightfully blamed. If the tonsils and adenoids should be removed for pathologic reasons, considerations of health should be primary and of speech secondary. But I cannot hold with the school of thought that says, in effect, that the offenders should be taken out even if they do not offend. Just to remove the tonsils and adenoids because of their presence may be working a definite harm without doing sufficient good.

To illustrate:

Case 4.—A twelve-year-old girl who had been operated on by her family physician two years before for removal of tonsils and adenoids complained of nasality and sigmatism nasalis. She had formerly been a member of her church choir and school choral society. For the past two years, she had been unable to sing without nasality, and although her speech also was severely affected, it was the change in her singing voice that worried her. Examination revealed a normal functioning palate, but of insufficient length to effect pharyngeal closure for oral phonation. The prior condition of good voice and speech was accomplished with the combination of the palate action and the presence of adenoids. Although training was followed for three months, the structure was incapable of sufficient adjustment. The parents are now considering the suggestion of a push-back operation to lengthen the soft palate.

There are other interesting anatomic defects that result in speech defects. They include, briefly, stenosis of the nares due to polypi; defects in hearing that lessen the acuity to good speech; the presence of nodules on the vocal cords, and many other oral, nasal and pharyngeal defects. I wish to elaborate on the anatomic defects that are more nearly the problem of the dentist; namely, faulty dental structures.

Logically, the most serious dental abnormality is absence of all the teeth. We are all conversant with the speech of these

patients. The only treatment for these cases is in your hands: replacement of the teeth. But this must be done with care, in making dentures not only of well-adjusted and beautiful teeth, but also that will do as much to restore speech as to restore the masticatory surface. It is well to note that the prolonged absence of the teeth may cause changes in the position of the arches formed by the anterior faucial pillar that may result in a change in resonance after the teeth are restored. Prepare the patient for this. Also, it is well to bear in mind that new dentures may require new tongue adjustments for the formation of proper speech. Prepare the patients for this. You all know that there are patients who refuse to cooperate in the making of necessary adjustments and who expect you to create a condition that will require no effort on their part after the teeth are restored. These possible adjustments should be an integral part of your discussions before you make the new teeth, not afterwards. According to one authority, a dentist, special care must be used in the construction of the mandibular dentures in this regard.[3] He also warns that the restoration of teeth with a short bite or thick incisors may cause similar difficulties in adjustment. Prepare your patient before you work, or resultant bad speech may become your burden.

The most common speech defect resulting from abnormal dental conditions concerns the sibilants, or s group of sounds. The speech defect is called sigmatism or lisping. The normal production of the s sound requires a fine blade of air directed against the cutting edge of the incisor teeth. When the incisors are missing or the tongue blankets the lower teeth, a lisp, technically known as a *sigmatismus simplex,* results. When the blade of air broadens and partially escapes through or over the side teeth, a lisp technically called *sigmatismus lateralis* results. Many of these defects appear in children owing to improper tongue position or to carry-overs from infantile speech that over-fond, but thoughtless, parents termed "cute." At other times, lisping due to cultivation is found in the adult female in attempts to allure. But, most frequently, these defects are due to faulty dental conditions, either now present or existing during some earlier period when the bad habit was formed. In the simplex type of defect, the incisor condition is important. If it is normal, speech training is immediately indicated. If not, the abnormal condition should be corrected first. In the *lateralis* type of defect, the presence of the upper molars or the first bicuspids is important. There are patients exhibiting a combination of these sigmatisms from the loss of several of the lower teeth.

Important to the dentist and the orthodontist is the condition of the patient's bite. Various abnormal bites result in poor speech. A retrocluded bite, with the lower jaw prognathic, will result in poorly formed f, v, p and b sounds.

An extended over-bite usually affects the sibilants s and z as well as the t and d sounds.

Obtrusion of the upper incisors affects at times the s, z, t, d, p and b; whereas an intrusion of the teeth may affect s, z, t and d.

CONCLUSION

Let me again stress the necessity of having a good machine, but let me likewise emphasize that a machine perfect in all its parts is satisfactory for use only if its parts are adjusted by thinking man to the intricacies of its work.

Training in making new adjustments should follow good repair. Making his part of the machine whole and able to do its work is the first concern of the dentist for his patients, but equally important is the training of the patient to run his newly perfected machine.

Rehabilitation of the patient's defective

personality is as much your work as repair of the teeth. Do not let a good repair job be ruined by stopping too soon.

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IMPORTANCE OF ORAL SYMPTOMS IN SYSTEMIC DISEASES

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IN the general advancement of medical knowledge, it becomes increasingly apparent that dentistry and medicine can be intelligently developed only with a more intimate association. To the detriment of both professions, dentistry has developed independently of medicine instead of progressing as a medical specialty.

When dental consultations are easily available, it is interesting to note the frequency with which oral symptoms may be the initial sign of a systemic disease. Dahldorf's experiments with vitamins show most convincingly that the dental observations were of extreme importance in evaluating the effects of the vitamin-deficient diets on the animals. In fact, these findings in the teeth were the most valuable single observation that he could determine and use as an indicator of avitaminosis. This contribution signifies that dentistry might be in a position to recognize early systemic disease, whereas it exists in medicine now only as a subclinical entity and is not routinely recognized. Martland and Gettler, in their work on radium poisoning, showed that, in practically all of the cases studied, one of the first symptoms apparent to the patient was dental sepsis. In this group, the dental lesions were believed to be due to the bombardment of the bone marrow by radium atoms with resultant reversion of the blood cells to aplastic types. The oral lesions increased in direct proportion to the degree of blood cell anaplasia. One of us (E. J. G.), in experimentally attempting to produce bone tumors, showed that laboratory animals, when they had ingested radium and other luminiferous compounds, developed extensive oral lesions comparable to those noted by Martland and Gettler in the human cases that they studied. In further examination of the laboratory animals, radio-active elements were very easily demonstrated in the teeth; and the dental significance from a physiologic aspect has attracted much attention. This experimentally proven relationship between oral disease and blood dyscrasia should, when the dentist considers his diagnostic responsibility, be of interest to him as it is to the physician. Modern dentistry, in view of accumulating evidence, must consider the possibility that certain oral manifestations indicate the presence of systemic disease, and should not confine its interests entirely to the problems of oral restoration and mechanics.

As illustrative of this principle, we wish to report a case of thrombocytopenic

purpura in which the first clinical sign of the disease was oral hemorrhage.

REPORT OF CASE

A woman, aged thirty-eight, came to the clinic, December 31, 1934, complaining of a weak, tired feeling of one week's duration. She thought that she was getting a "cold," but had had no sore throat nor fever. December 30, she had retired early, and awakened in the morning with her mouth filled with congealed blood. In the afternoon, bloody urine was passed, sores developed in the mouth, black and blue spots appeared all over the body and there was also a bloody discharge from the nose. The past history was essentially negative. On the previous admissions, six, five and one year before, focal infections in the teeth, tonsils and cervix had been treated. Menstruation, the week before admission, had been regular, lasting three to four days. On examination, purpuric spots and ecchymosis were found on the arms and lower extremities, Grade II (grading basis: I to IV). A few of these spots were present on the back also. There were small areas of edema and hemorrhagic infiltration in the mouth and pharynx. The tonsils were out cleanly. The teeth were negative for periapical infection and there were no pulpless teeth present.

The laboratory reports on the blood studies will be found in the accompanying table.

January 1, 1935, the patient started to bleed profusely from the mouth, nose, rectum, vagina and bladder. She was hospitalized immediately for control of the hemorrhage. The treatment included moccasin snake venom, transfusions, infusions and a diet high in vitamins and minerals. A course of x-ray therapy was given over the spleen, although it was not definitely palpated. At intervals of three to five days, for ten doses, 20 cc. of whole blood was injected intramuscularly into the buttocks. The patient, greatly improved, left the hospital two weeks after admission. The accompanying table gives the blood studies made before dismissal. The general condition of the patient continued to improve, although a normal blood picture was not found in the frequent studies made until April 15, 1935. Since that time, the patient has had a fortnightly or monthly re-examination and when she was last seen in January of 1937, all clinical and labatory data were well within normal limits.

LABORATORY STUDIES

	Dec. 31, 1934	Jan. 14, 1935	April 15, 1935
Hemoglobin	65% (Dare)	86% (14.5 gm.) (Neucomer)	66% (11.2 gm.) (Neucomer)
Erythrocytes	4,140,000	4,450,000	3,980,000
Leukocytes	5,500	7,700	6,200
Differential count			
Neutrophiles	59%		57%
Lymphocytes	28%		34%
Monocytes	4%		5%
Eosinophiles	7%		4%
Basophiles	2%		0%
Erythrocytes	Slight anisocytosis		
Platelets	30,000	46,000	275,000
Coagulation time (Lee)	17 minutes	16 minutes	11 minutes
Bleeding time	1½ minutes	1 minute	2 minutes
Retraction time	None, to 48 hours	None, to 24 hours.	35 minutes

SUMMARY

1. Attention is called to the importance of oral lesions as early indications of systemic diseases.

2. A case of thrombocytopenic purpura is reported in which the first clinical sign manifested was oral hemorrhage.

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HISTOLOGIC CHANGES IN TEETH DUE TO PLASTIC FILLING MATERIALS*

By W. B. Gurley, D.D.S., and Grant Van Huysen, D.D.S., Richmond, Va.

THE plastic filling materials have been of concern to the dental profession for many years, because the ease with which they are manipulated and the esthetic appearance of some of them have been offset by the fact that they occasionally have an injurious effect on the pulps of the teeth in which they are placed. It is a recognized clinical fact that serious injuries to the underlying pulp tissues do sometimes follow insertion of plastic fillings. The incidence of this type of injury is not high, and the reasons for its occurrence have not as yet been satisfactorily demonstrated, in spite of theories advanced with reference to it.

Byrnes,[1] for instance, makes the following statement: "But it must also be borne in mind that cement itself is irritating to the pulp," and yet he points out that "some dentists have found the use of black copper cement effective in treatment of pulps."

With regard to the use of silicate cement fillings, Rinehart[2] expresses the following opinion: "The operator should use every precaution to protect the pulp from close approximation to the filling, by placing a cement base or applying a soft oxyphosphate zinc cement first and then adding the silicate." On the other hand, Lewis[3] says, "I seldom use a cement base."

The point of view expressed on this subject by most texts of operative dentistry is well illustrated in Black's revised edition.[4] In considering zinc phosphate cement, he explains:

> They may also be used for temporary restoration in case of very sensitive dentin for the purpose of allaying the extreme sensitiveness, which is generally found to disappear, in large part at least, within a few weeks or months. They should be used for temporary restoration in case of hyperemia of the dental pulp, for the reason that their conductivity of thermal impressions is less than that of the metals, though in this respect gutta percha is to be preferred; also they may be used in capping exposed pulps.

The same text,[4] in discussing silicate cement, states:

> Unfortunately, these cements are deficient in practically all other desirable qualities for a permanent restoration and much actual harm to the teeth, followed by pulp involvements and their sequelae in the form of localized and systemic infection, are the price that must be paid by the patient for the better appearance of the teeth, usually over a comparatively brief period.

Paradoxical as the statements in the last two paragraphs may seem, they are only a few of many on the subject appearing in the literature. From these observations, one gets the impression that silicate cements are irritating to the pulp when placed in deep cavities, and that covering the floor of these deep cavities with zinc phosphate cement before inserting the silicate cement will prevent injury of the underlying pulp.

Fish[5] shows histologic evidence of the effect of operative procedures on the dentin and the pulp. These procedures consisted of preparing cavities in the teeth of

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dogs some of which were "cemented up," others left open. The animals were permitted to live through periods varying from eighteen hours to four months and at death decalcified histologic sections were made to show the dentin with the pulp. Fish wrote:

The degree of severity of the reaction in the pulp appeared to depend upon experimental factors such as the depth of the original cavity, whether it was left open to contamination by mouth fluids, or "cemented up," whether or not the dentin was overheated by the bur in cutting the cavity, and finally whether a dog or monkey was used.

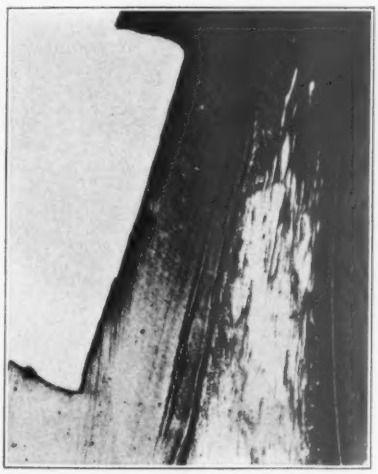

Fig. 1.—Histologic section taken from a dog's tooth containing cavity filled with temporary stopping for forty-three days. On the cavity side of the pulp, new dentin has been deposited in excess. (×30.)

Palazzi[6] cut deep cavities in the teeth of dogs and inserted fillings which, in the plastic state, were supposed to contain irritating chemicals. In the pulps of most of the teeth so treated, he found histologic evidence of inflammation characterized by small and large areas of hemorrhage, zones of reticular atrophy, leukocytic infiltration and, in many extreme cases, necrosis and destruction of the pulp.

Fasoli,[7] when repeating much of Palazzi's work, found that cement fillings placed in shallow cavities in the dentin of dogs' teeth produced reactions such as changes in the odontoblastic layer, abnormal production of secondary dentin and fibrous degeneration. If the cavities were deep and close to the pulp, there occurred a much more acute and far-reaching reaction of the pulp tissues. This was evidenced by extreme vascular changes such as hemorrhagic infarcts and necrosis of the pulp.

Manley[8] concludes his experimental work on the teeth of dogs as follows:

Fig. 2.—Higher magnification of Figure 1, showing details of new dentin and pulp periphery. There is marked infiltration of leukocytes. (×10 eyepiece; 16 mm. obj.)

(1) No reaction in the pulp need take place as a result of mechanical injury to the peripheral ends of the dentinal fibrils through the cutting of a cavity. (2) Certain filling materials, e.g., silver amalgam, silicate cements, copper oxyphosphate germicidal cement, give marked reaction in the pulp, and their reactions have distinctive characteristics due to a difference in chemical composition. (3) Zinc oxide and eugenol give no reaction and have no deleterious action on the pulp.

Kronfeld,[9] in his textbook on dental pathology, writes:

Every drilling or grinding of a tooth will lead to the formation of secondary dentin provided this operation involves the dentin. The extent and amount of the deposition of secondary dentin, under these circumstances, will depend upon the size and depth of the cavity, upon the age of the individual, upon the time that has elapsed since the operation was performed, and upon the individual reaction of the pulp.

This short review of the literature on the subject of the effect of outside irritants on the elements of the dentin and pulp is in no sense complete. It merely illustrates in a degree the difference of opinion in this phase of dentistry. In many cases, cutting or exposing dentin to either mouth fluids or to filling materials produces histologic evidence of changes in the elements of the dental pulp. On the other hand, as Manley[8] has observed, no change need take place under fillings of zinc oxide and eugenol. Fish[5] observed no change under any of his "cemented up" cavities; whereas Fasoli[7] and Palazzi[6] observed many changes both chronic and acute, productive and destructive, beneath the fillings that he placed in the teeth of experimental animals. The facts of the matter are that, in spite of the immense amount of effort being put forward by the dental profession to avoid the sequelae of pulp damage, there is still relatively little exact information about the effect of these procedures on this organ that is being so assiduously and expensively conserved.

In a study of pulp reaction from external conditions, it is believed necessary to emphasize the fact that the soft tissue tooth pulp and the hard tissue dentin are two united parts of one tissue. Tomes,[10] in his classic work, showed that the protoplasmic processes of the odontoblasts extend into the dentinal tubules and in this way provide the hard part of the tissue with living protoplasm. Mummery,[11] von Korff and Orban[12] have shown that the connective tissue fibers of the dentin are continuous with the fibers of the pulp proper through the connecting argyrophile interodontoblastic fibers. Von Ebner described the fibrous nature of the

Fig. 3.—Histologic section showing cavity that had been filled with zinc oxide and eugenol for a period of forty-seven days. The junction of the pulp and dentin forms a continuous even line. (×30.)

Fig. 4.—Higher magnification of area of dentin and pulp adjacent to deepest part of cavity shown in Figure 3. (×10 eyepiece; 16 mm. obj.)

dentin matrix and showed that the fibers have the same characteristics as those of the collagenous intercellular substance of any connective tissue. Orban[13] has also very convincingly shown the resemblance of these two parts, dentin and pulp, to connective tissues.

When examined in the light of our knowledge of the histology of teeth and connective tissue, the line of demarcation between the hard dentin and the soft pulp is non-existent. There is at the periphery of the pulp a more or less distinct change in the gross physical properties between the calcified and non-calcified tissues, but

Fig. 5.—Histologic section made from dog's tooth containing cavity filled with red copper cement. The cavity lies very close to the pulp at one end and away from it at the other end. There is destruction of the pulp adjacent to the deep end of the cavity and secondary dentin formed adjacent to the shallow end. (×30.)

histologically there is a definite bridging of this line by the cellular odontoblastic processes on the one hand and fibrous intercellular elements on the other hand. With this twofold structural intimacy, it is logical to believe that any interference with one part will result in manifest changes in the other part. With respect to this idea, Kronfeld's opinion of the physiologic relationship between the dentin and pulp has already been given.

PURPOSE

It is the purpose of this study to describe the histologic appearance of the dentin and pulp of certain teeth removed from young dogs. These teeth have been subjected to operative procedures which consisted of preparing and filling cavities with various cements and with temporary stopping.

PROCEDURE

Kronfeld,[9] preparatory to the discus-

Fig. 6.—Higher magnification of Figure 5, showing pulp adjacent to deep end of cavity.

sion of the pathology of the teeth, describes in his textbook certain "regressive changes in pulp and dentin," which he states are "on the border-line between normal and pathological," and which occur during the aging of the pulp. To avoid these changes, young dogs were selected from the city pound by examining their mouths macroscopically and choosing only those that were old enough to have the permanent dentition complete but whose teeth as yet showed no evidence of abrasion. In this way, it was possible to

obtain dogs whose tooth pulps were large and free from changes common to older animals.

The dogs were prepared for operation by complete anesthetization with nembutal (sodium pentobarbital), regularly used in veterinary medicine for operations on small animals. This anesthetic is given intraperitoneally in doses of one grain for every five pounds of body weight. The mouth of the anesthetized animal was propped open and the posterior part packed with gauze. In addition, the mucous membrane surrounding the field of operation was isolated with gauze, swabbed with 45 per cent alcohol and allowed to dry in air. Cavities were carefully prepared in the gingival third of the labial surfaces of the canine teeth, with sharp, slowly revolving No. 38 inverted cone burs. The cavities were extended well beneath the free gingival margin, and heat generation was minimized by directing air with a chip blower at room temperature at the cutting edge of the bur. The depth and other cavity dimensions were variable and are therefore discussed later in the histologic consideration of each tooth. The cavities were then cleaned with alcohol on a pledget of cotton and permitted to dry in air. In certain cases, there was a slight departure from this procedure, but any variation in treatment will be noted at the time the histologic description of the pulp is given. The prepared cavities were then filled with the plastic material chosen for each one. The restorations were permitted to remain in their respective cavities from forty-three to forty-seven days.

At the end of the experimental period, the dogs were anesthetized with ether. In most of the cases, the thorax was opened, and a cannula was placed in the aorta above the diaphragm and was directed toward the head of the animal. The external jugular veins were then cut and the anterior portion of the animal was perfused with warm (45° C.) saline (0.9 per cent) followed by a solution of formaldehyde (4 per cent) of the same temperature. This procedure was deemed advisable (1) to clear the vessels of the

Fig. 7—Higher magnification of Figure 5, showing secondary dentin and pulp adjacent to shallow end of cavity.

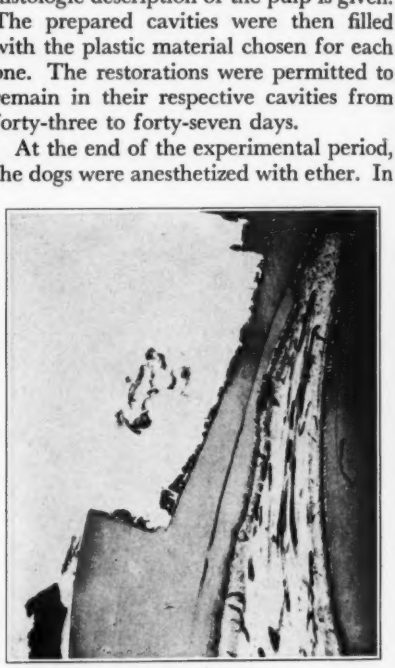

Fig. 8.—Histologic section taken from dog's tooth that was filled with zinc phosphate cement, showing uneven deposit of secondary dentin, blood vessels filled with cells and displacement of the odontoblastic layer. (×30.)

pulp of all blood cells that might be there as a result of terminal agonal phenomena and (2) to fix the pulp tissue if possible at the time of death. After the flow of the formaldehyde stopped, the canine teeth were removed; the apical one-third of each root was cut away, and the tooth was placed for fixation in Zenker's formol solution. Exceptions to this procedure are noted at the time the histologic sections are described. The tooth was decalcified and embedded in celloidin and serial sections were made fifteen microns thick. The sections were stained with hematoxylin, eosin and azure II.

Fig. 9.—Higher magnification of histologic section shown in Figure 8. The area shown in this illustration is at the "tied in" portion of the secondary dentin. Hyperemia and localized and generalized infiltration of leukocytes in addition to increase in the dentin are evident. (×10 eyepiece; 16 mm. obj.)

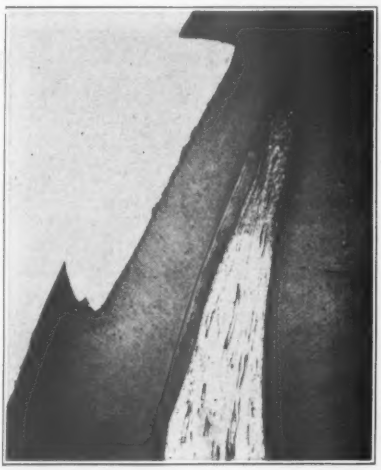

Fig. 10.—Histologic section taken from dog's tooth that had contained silicate cement filling. Secondary dentin has formed over the entire area of the pulp chamber subtended by the cut tubules. (×30.)

The technic used for making histologic sections of the teeth is that suggested and used by Orban.[14]

HISTOLOGIC SECTIONS

In this study of the effect of plastic filling materials on the teeth, the following types of materials were used: (1) temporary stopping, (2) zinc oxide and eugenol, (3) red copper cement, (4) zinc phosphate cement and (5) silicate cement. In consideration of the possible effect of these operative procedures, only one cavity dimension is assumed to be of interest; that is, how close the cavity floor is to the pulp. Accurate and positive determination of the thickness of this dentin between the cavity and pulp was obviously not possible at the time the cavity was prepared. Measurement of the thickness of the dentin between the floor of the cavity and the pulp is therefore made in all of the serial sections, but for the description in the following pages only one slide from each tooth is used. The section used is the one in which the dentin between the cavity floor and the pulp is the thinnest.

TEMPORARY STOPPING

The first pulp reaction observed took place in the maxillary right canine tooth of a 7.7 kg. dog (No. 6). The cavity had

been treated for ten minutes with phenol, dried with air and filled with temporary stopping. Forty-three days later, the dog died during perfusion under ether anesthesia. The canine teeth were removed and serial sections prepared.

Figure 1 shows that along the pulpal wall on the cavity side there occurs a bulging of the dentin into the pulp chamber. Here, one can see that a definite increase in the amount of dentin has taken place. This added thickness of dentin, when measured with a micrometer eyepiece, is about 0.1 mm. Closer examination of the dentin proceeding from the cavity floor toward the pulp reveals a

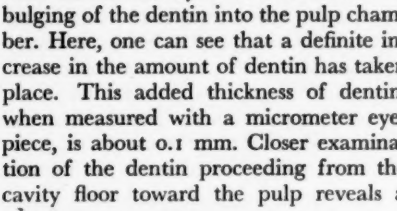

Fig. 11.—Higher magnification of pulp periphery and dentin adjacent to it; taken from center of affected area shown in Figure 10. There is a mild infiltration of leukocytes. (×10 eyepiece; 16 mm. obj.)

relatively thick (0.83 mm.) layer of dentin. This thick layer of dentin is finally broken by an irregular dark line, which is interpreted as evidence of the reaction that followed the cutting of the cavity in the dentin. Fish[5] states that it represents an area of increased calcification or a plugging of the dentinal tubules in response to and as a future safeguard against irritation of pulp elements by harmful agents that might gain access through the cut tubules.

In this discussion, this line will be termed the "line of injury," because it is presumed that it occurred at the time the cavity was prepared and the protoplasmic odontoblastic processes were cut. Following this first dark line of injury, there is a thin irregular lighter line. This in turn is followed by another irregular darker line. The second dark line is thinner and more attenuated than the first line. From this second dark line to the pale odontogenetic layer, the dentin is faintly laminated (Fig. 2). In addition to this extra dentin deposit with its laminated appearance, one can see that the odontoblastic layer has been retracted pulpally to a new position at the inner edge of the added dentin (Fig. 1). This new line is continuous with that of the line of odontoblasts of the rest of the pulp and is not otherwise noticeably changed.

Figure 2 shows a fairly heavy but diffuse infiltration of leukocytes in the pulp tissue adjacent to the displaced odontoblastic layer. The vessels of the pulp chamber as seen in both illustrations, however, are free from blood cells. There is around the periphery of the entire pulp chamber, both in the affected area and outside of it, a more or less uniform odontogenetic layer; which may be interpreted as evidence of the fact that at the time of death of the animal, dentin was being laid down about the pulp chamber in a normal fashion. The thickness of this layer is the same in the affected area as it is in the unaffected area of the pulp. Judging from the presence of this odontogenetic layer, the bulging additional 0.1 mm. of dentin laid down adjacent to the cavity must have occurred nearer the time of the operation than the time of the death of the dog.

ZINC OXIDE AND EUGENOL

Figure 3 shows a low (×30) magnifica-

tion of one of the serial sections taken from the mandibular right canine tooth of the 10 kg. dog (No. 5). This histologic section is selected because it shows the thinnest (0.44 mm.) portion of dentin between the cavity floor and the pulp. This cavity was filled with a mixture of zinc oxide and eugenol, and the tooth remained in the mouth for forty-seven days thereafter. It is not possible in this section to get as clear view of the pulp as might be desirable because of the lack of uniformity of the stain. One can see from Figure 3 that the dentin and pulp both form a continuous curved line following in a general way the contour of the tooth. Some of the pulpal blood vessels are filled with cells which make them stand out quite clearly in the photograph. (This dog's head was not perfused with saline and formaldehyde solution.) In that portion of the pulp chamber toward the root and on the opposite side with respect to the cavity, one can see a clear space occupying a relatively large part of the pulp chamber. It is not known what caused this large vacuole, but it probably occurred sometime during the decalcification of the tooth in the preparation of the histologic sections.

Figure 4 is a higher magnification of the material in Figure 3 showing the pulp and dentin in an area adjacent to the deepest portion of the cavity. This higher magnification was made with a Spencer microscope using a ×10 eyepiece and a 16 mm. objective. It shows in detail the elements of the pulp and dentin associated with the floor of this cavity that contained the zinc oxide and eugenol filling for a period of forty-seven days. These elements show little or no evidence of having been disturbed. If one compares the odontoblastic layer on the side toward the cavity with that on the opposite side, little or no difference is seen. The pulpal blood vessels contain a few cells; however, they do not seem overfilled. Examination of either Figure 3 or 4 shows the absence of any odontogenetic layer of predentin. The pulp appears in all other respects quite normal.

RED COPPER CEMENT

Figure 5 shows one of the serial sections prepared from the mandibular right canine tooth of a 4.8 kg. dog (No. 7). This cavity, after its preparation, was filled with red copper cement, and the filling remained in the tooth for a period of forty-three days, when the dog was killed, and perfused with saline and formaldehyde solutions, and the tooth was removed for the preparation of serial sections. The cavity is very close (0.11 mm.) to the pulp at the incisal end and much farther away (1 mm.) at the gingival end. In the pulp chamber approximating the deep portion or incisal end of the cavity, there is present evidence of extreme pulp damage with heavy localized areas of cellular infiltration (Fig. 6). There is also evidence of resorption of the dentin itself at a point touching the area of heaviest cellular infiltration.

The tubules cut by the shallow gingival half of the cavity floor open inwardly on an area covered with a layer of secondary dentin, indicative of a chronic productive type of injury. One can see separating the area of secondary and primary dentin a dark irregular "line of injury" that is continuous with the line of the pulp chamber in the incisal area of severe injury. The fact that this dark line is continuous incisally with the line of the pulp chamber in the severely affected area is pointed out as substantial evidence that it represents what was the outline of the pulp chamber at the time of injury. It is also believed that the pulp opposite the deep end of the cavity was injured severely at the time the cavity was prepared, not by a direct mechanical break in the pulpal wall, but by anatomic exposure through the shortened dentinal tubules.

This section illustrates the effect of proximity of cavity floor to the pulp when the cavity is filled with red copper cement. (Compare Figures 5, 6 and 7.) There is

an acute destructive reaction when the filling is placed close to the pulp, and a chronic reparative reaction when the filling is placed at a distance from the pulp. Apparently, the thickness of the dentin between a copper cement filling and the pulp is significant.

Examination of the dentin of the other side of the pulp chamber wall shows that there is also a "line of injury" on that side and that there is an appreciable amount of secondary dentin attached to the chamber wall. This is interpreted as evidence of a reaction on the unaffected side, a result of the severity of the stimulus applied to the pulp by the operative procedures on this tooth. The blood vessels of the entire pulp show extreme engorgement, particularly near the deep end of the cavity. The odontoblastic layer is separated slightly from the areas of secondary dentin on both sides of the pulp chamber and, except for a little proximal separation of the cells, is not abnormal in appearance.

ZINC PHOSPHATE CEMENT

Figure 8 shows a histologic section through the mandibular left canine tooth of a 10 kg. dog (No. 5). At the magnification used (×30), one can see a deep cavity floor; that is, toward the pulp, there is visible a thin uneven dark "line of injury," which is interpreted again as representing the line of the pulp chamber at the time the cavity was prepared. The thickness of the dentin between the floor of the cavity and the old outline of the pulp chamber varies, according to measurements made, from 0.29 mm. at the central or deepest part of the cavity to 0.50 mm. toward the gingival end of the cavity, or the shallowest point.

Secondary dentin has been deposited on the pulpal wall adjacent to the openings of the tubules cut by the cavity. Comparing the secondary dentin laid down here with that of a previous tooth (Figs. 1 and 2), one notes that there is only one irregular dark line and that the secondary dentin is of a uniform shade with no laminations. The area of secondary dentin is not of a uniform thickness, but is noticeably thinner or "tied in" at about its center. Measurement of the thickness of this secondary dentin shows it to vary from 0.12 mm. at its thickest portion toward the incisal end to 0.08 mm. at the thinnest portion or about at its center. If the dentin on the opposite side of the tooth is examined, there will be noted a very thin uneven line corresponding to the "line of injury" on the affected side. It is believed that this was produced at the time the cavity was prepared in the dentin of the other side of the tooth and that the line represents a sympathetic reaction.

At the center of the affected area where the secondary dentin is thinnest, one can see a more or less circumscribed area of hyperemic vessels in the vicinity of the odontoblastic layer. Observation of this area under higher magnification (Fig. 9) shows that the odontoblastic layer is disrupted, with destruction of some odontoblasts. The odontoblasts have been displaced by heavy localized accumulations of leukocytes about a few capillaries. Apparently, the destruction of this small portion of the periphery of the pulp, which is due to hyperemia and cellular infiltration, had interfered with dentin formation for some time before the dog was killed. There is also in the vicinity of the odontoblastic layer on the same side of the pulp chamber a definite diffuse infiltration with white blood cells. The picture, it is believed, illustrates a subacute inflammation or an acute inflammation superimposed on a chronic one.

This mandibular left canine tooth and the mandibular right canine used for the study of the effect of zinc oxide mixed with eugenol are from dog No. 5. Histologic sections were also prepared from the maxillary left canine tooth of the same dog. The maxillary left canine tooth was not operated on to provide sections that would illustrate a normal pulp. The sections from all three teeth, whether filled with zinc oxide mixed with eugenol, or

with zinc phosphate cement or left untouched, show an absence of an odontogenetic layer. Sections from all three teeth show vessels filled with red and white blood cells distributed throughout the body of the pulp. In the section taken from the tooth containing the mixture of zinc oxide and eugenol, the vessels are not so large, nor are they quite so numerous as in the other two, but the vessels that are present are filled with cells. This may be accounted for in all three cases by the fact that the dog was not perfused with saline or formaldehyde solution. In spite of the lack of perfusion with formaldehyde solution, all of the sections from this dog are well stained; which would indicate that fixation is as good without perfusion with formaldehyde as with it.

SILICATE CEMENT

Figure 10 shows a histologic section made longitudinally through the mandibular right canine tooth of dog No. 6. The cavity is a shallow one, the floor running along a line that is at least 1 mm. from the pulp chamber. This untreated cavity was filled with silicate cement under usual conditions. The filling remained in the tooth forty-four days, when the animal was killed and histologic sections of the tooth were prepared. Secondary dentin 0.2 mm. thick has been laid down along the periphery of the pulp over an area subtended by the tubules cut during the preparation of the cavity. A definite line of demarcation, "line of injury," can be seen between the primary and secondary dentin. The odontoblastic layer has, of course, receded to a new location internally from the secondary dentin. The vessels of the pulp are free of cells.

Figure 11 shows under higher magnification (× 10 eyepiece and 16 mm. objective) an area taken from the slide shown in Figure 10. This figure shows the pulp on the side of the tooth containing the cavity. It is sparsely infiltrated with round cells and the odontoblastic layer is disturbed, being very thin in depth and attenuated in its long direction so that, in certain areas, it is almost incomplete. There is visible in Figure 11 a thin layer of lighter-stained dentin matrix immediately peripherad to the disturbed odontoblastic layer. This so-called predentin or odontogenetic layer has been interpreted as evidence of the fact that dentin was being deposited at the time the tooth was removed. In this case, the dentin (Fig. 10) was being laid down about the entire periphery of the pulp chamber in both the affected and the unaffected parts of the pulp chamber periphery.

COMMENT

Fish[5] states that there were no changes in the teeth following the filling of cavities in experimental animals' teeth with cement. The present study and that of Manley's[8] show quite definitely, however, that changes do take place under the ordinary cement fillings. These changes are not necessarily of a destructive nature, but, conversely, are often productive in type; that is, secondary dentin is deposited. Palazzi[6] produced effects that were much more severe than those shown in this and Manley's report, but, as has been shown by Fasoli,[7] this was probably due to the unusual depth of the cavities used by Palazzi.

If the results obtained by Manley are compared with the data reported here, indications are that the severity of reaction in the pulp is due either to the depth of the cavity or to the closeness of the filling material to the pulp, and the kind of material used to fill the cavity. The interrelation of the proximity of the cavity to the pulp, the type of filling used and the succeeding reaction of the underlying pulp and dentin is demonstrated in Figures 3 and 8. If the cavity is very near the pulp and filled with a cement whose liquid is phosphoric acid, a destructive reaction occurs in the pulp. However, if a similar cavity is filled with the same cement, eugenol being substituted for the phosphoric acid, no reaction occurs.

When a thick layer of normal dentin separates the pulp from either cement fillings or temporary stopping, the reaction is productive, with the addition of secondary dentin in the affected area. Zinc oxide and eugenol used to fill a cavity or as the lining of a cavity is believed to exert an active palliative effect on the elements involved in the cutting and filling of cavities in teeth.

SUMMARY

Certain phenomena took place in the pulp and dentin of dogs' teeth when cavities were cut in them and filled with plastic materials. The tests here described extended over a period from forty-three to forty-seven days and the filling materials used were (1) temporary stopping, (2) zinc oxide and eugenol, (3) red copper cement, (4) zinc phosphate cement and (5) silicate cement. The filling materials were placed, generally speaking, as follows: Some at a distance from the pulp, or, roughly, 1 mm. from it; and some close to the pulp, *i.e.*, within 0.44 mm. In two instances, the cavity floor was sloped so that part of the filling lay close to the pulp (0.1 mm. away) and the other end farther away (1 mm.) from it.

These procedures were followed by changes in the dentin and pulps of the experimental animals as follows: 1. Zinc oxide mixed with eugenol prevented pulp reaction. 2. Temporary stopping and silicate cement in cavities 1 mm. from the pulp resulted in the deposition of secondary dentin or a productive reaction. 3. Red copper cement produced a destructive reaction where it was situated close to the pulp (0.1 mm.) and a productive response when situated at a distance from the pulp (1 mm.). 4. When zinc phosphate cement was placed close to the pulp, there was a destructive reaction superimposed on a productive reaction.

CONCLUSION

1. Filling of cavities with the cements or temporary stopping is followed by changes in the underlying pulp and dentin histology.

2. Destructive changes are evident when the cavity and fillings lie close to the pulp; but secondary dentin is deposited when they are placed at a distance from the pulp. These phenomena may take place in the same tooth.

3. Reaction of the pulp may be prevented by filling or lining cavities with a mixture of zinc oxide and eugenol.

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A SPECIFICATION FOR TOOTHPASTE*

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THE United States Government purchases large quantities of toothpaste for use in its hospitals and similar institutions. Wherever practicable, government purchases are made on specifications. In 1935, the Procurement Division of the U. S. Treasury Department named a committee to investigate the possibility of formulating a specification for toothpaste. It was desired that this item be purchased in competition, with the assurance that only first quality products would be admitted to the competition.

This committee was composed of H. E. Harvey, of the Navy Dental Corps, M. M. Fowler, of the Veterans Administration and the senior author of this paper.

The question whether toothpaste should be regarded as a medicine or as a cosmetic was disposed of without extended discussion. It was admitted that in certain instances a medicated preparation could be of value in treating a definite oral pathologic condition. It is quite generally recognized that in conditions requiring a medicated dentifrice, there should be frequent medical or dental inspection. No attempt was made to prepare a specification for a medicated toothpaste. This must remain a special problem for the dentist or physician who assumes responsibility for the special prescription and supervises its use.

The data available on dentifrices were not sufficient for the needs of the committee in preparing the specification. Laboratory tests had to be made to secure much of the information needed, and it is from the experience gained in making these tests that we are encouraged to offer this paper.

Formulas for toothpaste are available in many texts. Advertising literature and radio programs spread the claims for unusual virtues of innumerable ingredients which are supposed to be necessary in a first quality toothpaste. A prescription or formula including all these ingredients would be designated by medical experts as a "shot-gun" prescription.

The toothpaste problem need not become complicated, or burdensome except in those rare cases of pathologic conditions. Exhibits are before us daily wherein normal oral health has been maintained by the use of extremely simple materials. Safety from injury to oral tissues is the first item to be considered. Next comes the question of efficiency in removing foreign materials from the teeth. Convenience in marketing and using the product also demands attention. And last comes that final touch of flavor or perfume, which is permissible after the teeth have been cleaned. In no case is it wise to substitute this last item for any preceding item.

The foundation for a toothpaste is a powder and plasticizer one or both of

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which possess detergent properties. These must not be abrasive to enamel. The compound must be and must remain homogeneous. Segregation, fermentation or hardening during transportation and storage cannot be permitted. The extremes of temperature which are encountered in the Canal Zone, Alaska and other territories or possessions of the United States must not cause the paste to depreciate.

Excess acidity or alkalinity and the presence of poisons must be avoided. Escharotic properties are not desired. A preservative and a flavor complete the catalog of ingredients which must be given attention.

The test for abrasiveness was the most troublesome problem encountered. Our first attempts at measuring abrasiveness were based upon the assumption that abrasive materials could be detected and their abrasiveness measured quantitatively by holding disks against rotating tables on which toothpaste was spread. Silver disks and glass disks (about the size of a 50-cent piece) were mounted in special holders and thrust against rotating tables coated with paraffin. Later, these tables were coated with a special grade of polishing velvet. Commercial brands of toothpaste and standardizing mixtures were spread over these rotating tables and the loss of weight was determined for each disk after a relative travel of 1 mile in thirty minutes.

The losses were usually only a few tenths of a milligram; and although the disks were run in groups of three on each table, the losses were not uniform for the individual runs. Repeat tests did not give the same relative amounts of loss. We became completely discouraged when we discovered that the addition of 10 per cent of fine emery (0.001 inch diameter) to a paste of minimum abrasiveness did not, when the emery was fed between the disk and rotating table, increase appreciably the loss in weight of the disk. One explanation for this unexpected result is that the film of soap or some other ingredient of the paste is sufficiently thick to prevent the two surfaces coming near enough together to abrade. Attempts at diluting the pastes until this film was destroyed were not successful.

Unable to master the situation by this method, we next sought a test method severe enough to detect positively the presence of abrasives in toothpaste. Grinding the paste between the teeth in the mouth left no uncertainty as to the presence of this fine emery in amounts much less than 1 per cent. On very small percentages of emery, there would undoubtedly be questions and differences of opinion between individual observers, if we should attempt to use this test as a basis for acceptance or rejection. This simple test has the further disadvantage that it is not possible to display the results and thus eliminate the personal equation. A modification was devised in which a piece of glass coated with the paste was rubbed with a copper rod. The emery disclosed its presence with the first stroke of the rod. Permanent scratches were left on the glass.

To make this test of practical value, we should select a glass of hardness or resistance to abrasion equal to that of human enamel and a rod softer than the glass. Human enamel is not uniform and no single grade of glass can accurately represent all enamel. The final selection was a soda-lime glass of the grade used in the non-corrosive microscope slide. This glass is harder than any enamel measured in the Bureau's cooperative research. (To be published in THE JOURNAL, January 1938.) The metal selected was the copper-nickel alloy used in the 5-cent piece. In making this test, one should run a control test, pressing the edge or rim of the alloy against the slide and moving it across one end of the slide about 100 times. The slide should then be treated with aqua regia, or nitric acid, to remove any possible metallic deposit abraded from the copper-nickel alloy. If

no scratches are evident on visual inspection, the glass slide should then be coated with the paste and the test repeated. The pressure during the test should be considerably less than the pressure necessary to break the microscope slide; say, about 5 pounds. The amount of pressure used appeared to be relatively unimportant as long as contact between the coin and glass was felt from the rubbing motion. This test was sensitive enough to detect 1 part of emery in 100,000 parts of paste. It was therefore amply sensitive for incorporation in the specification.

Comments on the limits or restrictions on poison content, particle size, acidity, color and flavor are scarcely necessary. The reasons for the values adopted will be evident to any one familiar with this subject. Instruments used and methods of making tests, where tests are necessary, are explained in the specification.

The absence of many "magic" ingredients will be discovered if one gives attention to this part of the specification. Much study was made of the subject of composition. Claims for special virtues of an ingredient, if supported by no data beyond a patent, were not accepted. Ingredients having recognized detergent values could not be admitted on these values alone. The possibility of dissolving enamel or producing other types of injury had to be answered by satisfactory laboratory data or by sufficiently prolonged clinical observations. Many popular commercial pastes fail to meet the requirement of composition. The burden of proof that the extra ingredients are really necessary and that they are truly harmless is upon the sponsors of such extra ingredients.

The first use of this specification was in the purchase of 14,000 dozen tubes of toothpaste for the government. In this instance, a special procedure was followed. Bid samples were accepted and tests were made, beginning with the lowest in price. Rejections of defective materials were made without imposing the usual fine or penalty for submitting a material not meeting the specification. The first five brands were rejected because of abrasion.

Of twenty-five popular brands of paste (in 1936), ten failed to pass the abrasion test, whereas eleven failed to pass other tests. Hardening, segregation, and fermentation were the most common faults. Some showed stain or chemical attack on the inner surface of the tube. In one case, small holes, due to corrosion from the toothpaste, appeared in the tube after storage.

The specification now in use by the United States Government is included in this paper and is available for use by the American Dental Association, dental schools or other interested agencies. Modifications can be made where necessary to meet the needs of the agency. A pleasant effective material can be made to comply with this specification at a reasonable price. Manufacturers are at liberty to guarantee on their own responsibility that their product does comply with the specification when in fact it does comply. In such instances, approval of the flavor or absence of flavor rests with the purchaser. Similar conditions apply to the size of the tube, labels, etc. The formula if available, will save much unnecessary work when chemical analysis for compliance in composition is made.

FEDERAL SPECIFICATION FFF-D-191 FOR DENTIFRICE; TOOTHPASTE*

A. APPLICABLE FEDERAL SPECIFICATIONS.

A-1. There are no other Federal specifications applicable to this material.

B. TYPE.

B-1. Toothpaste shall be of the paste or cream type.

*This specification was approved by the Director of Procurement, for the use of all departments and establishments of the Government, and shall become effective not later than November 15, 1937. It may be put into effect, however, at any earlier date after promulgation.

C. MATERIAL AND WORKMANSHIP.

C-1. The toothpaste shall be free from materials other than those specified and shall be uniform in composition.

D. GENERAL REQUIREMENTS.

D-1. The toothpaste shall, when used in the normal manner, assist in the removal of the usual daily accumulations of débris and deposits from the exposed surfaces of the teeth without injury to the teeth, mucous membrane of the mouth or body in general.

D-2. The toothpaste, when applied undiluted to the mucous membrane of the cheeks and gums for a period of two minutes, shall not produce irritation or unpleasant symptoms.

D-3. The flavor shall be distinct and pleasant or shall be as specified in the bid proposal.

D-4. The color shall be (a) white, (b) cream, or (c) pink, as specified.

D-5. The toothpaste shall extrude from the tube in a continuous mass at a temperature of 10°C. (50° F.) without the application of excessive force, such as would cause injury to the tube.

D-6. Paste extruded from the tube (orifice down) to a length of 10 mm. at a temperature of 20° C. (68° F.) shall remain attached to the tube for at least fifteen seconds.

D-7. The toothpaste shall not segregate, ferment or deteriorate when cooled to a temperature of −15° C. (5° F.) for one hour or when heated to a temperature of 50° C. (122° F.) for seventy-two hours.

D-8. The formula shall accompany the bid proposal.

E. DETAIL REQUIREMENTS.

E-1. *Composition.*—Toothpaste shall be made from combinations of two or more of the following ingredients and within the limits specified:

E-1a. Forty per cent or more (by weight) shall be from the following detergents: calcium carbonate, dicalcium phosphate, tricalcium phosphate, magnesium carbonate, magnesium hydroxide.

E-1b. The following detergents, preservatives and flavors are limited in their use (if used) as follows: soap (hard or soft) U.S.P. XI (not over 20 per cent), sodium benzoate (not over 2.5 per cent), thymol (not over 0.1 per cent).

E-1c. Sugars and saccharin are permitted without limit except as limited by flavor or other tests.

E-1d. The use of one or more of the following detergents, plasticity and acidity regulators in proper amount shall be permitted:

1. Sodium bicarbonate
2. Sodium borate
3. Sodium carbonate
4. Sodium chloride
5. Boric acid
6. Citric acid
7. Acetic acid
8. Cream of tartar
9. Gelatine
10. Gum karaya
11. Gum tragacanth
12. Irish moss
13. Petroleum jelly
14. Mineral oil
15. Alcohol
16. Ethylene-glycol
17. Glycerine
18. Water

E-1e. The use of flavors and colors, permitted by the U. S. Food and Drug Administration for use as food dyes and flavors, in proper amounts, shall be permitted.

E-2. One hundred per cent shall pass through a U. S. Standard No. 100 sieve and 98 per cent shall pass through a U. S. Standard No. 200 sieve.

E-3. Toothpaste shall not contain appreciable amounts of the commonly recognized poisonous elements such as arsenic and heavy metals.

E-4. The pH value for the toothpaste, when diluted with four parts of water to one part of toothpaste (by weight), shall be greater than the number 4.9 and less than the number 10.1.

E-5. The toothpaste shall not scatch glass.

E-6. *Bid sample.*—Each bid shall be accompanied by a 2-ounce sample of the toothpaste which the bidder proposes to supply if awarded the contract. (The size of this tube and the label need not be in conformity with this specification.)

F. METHODS OF INSPECTION AND TEST.

F-1. *Tests.*—

F-1a. *Flavor and color.*—Inspections for flavor and color shall be made on the bid sample prior to awarding the contract. Material differences in flavor or color of the toothpaste delivered on contract shall be sufficient cause for rejection.

F-1b. *Sieving.*—The paste shall be diluted and sieved, a brush being used when necessary to break up adhering or coagulated particles. The residue shall be dried before weighing. Less than 0.5 per cent residue shall

be neglected unless the residue is in itself objectionable.

F-1c. *Purity.*—The methods specified in the U.S.P. XI shall be used for the detection of poisons and impurities.

F-1d. pH *values.*—The glass electrode and potentiometer shall be used for the determination of pH values.

F-1e. *Abrasion.*—

F-1e(1). Toothpaste shall be placed on glass and rubbed with a copper alloy similar in composition and shape to the 5 cent coin which has previously been rubbed against glass without scratching. The glass shall be of the usual soda-lime grade such as is used in non-corrosive microscope slides.

G. PACKAGING.

G-1. *Packaging.*—

G-1a. The containers shall be of the usual collapsible tube type having screw caps. The containers, including cap, shall not be attacked, chemically, by the toothpaste. Tubes shall be of tin or aluminum properly treated so that the flow of paste will cease when pressure on the tube is released. The area of the orifice through which the paste is to be extruded shall be greater than 13 square millimeters and less than 36 square millimeters. Orifices shall not have minor dimensions less than half the major dimension.

G-1b. Unless otherwise specified, each tube shall contain not less than 2 ounces of toothpaste.

THE APPLICATION OF DENTISTRY FOR CHILDREN

By Mary Martin, D.D.S., San Francisco, Calif.

THE definition of application according to Webster is the "testing or carrying into effect of a general law, truth, or precept, by bringing it into relation with practical affairs." In this paper, I hope to present a few practical suggestions that I have found helpful in caring for children.

Dentistry for children is different from that for adults but the same general fundamental principles of dentistry apply to children's work.

To care for children successfully, the operator must have confidence in what he is doing before the confidence of the child can be gained. To gain confidence, a thorough understanding must be had, first, of our general principles of dentistry, and then as to how these laws apply to conditions in children's mouths, which are different from conditions in the adult mouth.

To begin with, the anatomy of the deciduous teeth is different from that of the permanent. Though many of the teeth have the same general outline form on a smaller scale, the upper and lower first deciduous molars are entirely different from any in the permanent set. Generally speaking, the enamel is thinner, whiter and more brittle in deciduous teeth. The tubuli in the dentin are larger and the pulp is larger in proportion than in permanent teeth. From recent research work done by Dr. James Nuckolls, we now have a more definite knowledge of the size and location of the pulpal horns in deciduous teeth. This knowledge makes the preparation of cavities more exact and fewer pulp exposures need be made in the future.

This fear of exposing a pulp in a deciduous tooth has kept many operators from establishing sufficient retention in a cavity

(Read before the Section on Children's Dentistry—Mouth Hygiene at the Seventy-Third Midwinter Clinic of the Chicago Dental Society, February 17, 1937.)

preparation to hold an amalgam filling; also, many operators have left caries, fearing that a pulp exposure might be made. Needless to say, when caries is not completely eliminated, trouble is bound to occur in the future.

Another difference in dentistry for children as compared with adult work is the process of the development of the mouth as a whole. The eruption of the deciduous teeth and their loss and the eruption of the permanent teeth is an ever interesting study in children's dentistry. Following are the outstanding periods in this normal process of development:

1. At four years of age, spaces between the anterior teeth should appear in preparation for the eruption of the permanent teeth at or near the age of six.

2. At eight years, the four upper and four lower incisors should be in place.

3. From ten to twelve years, the bicuspids and cuspids should be replacing the deciduous molars and cuspids.

This process is not always so simple as it sounds. Children vary so much in their growth that often the new teeth erupt before space has developed, and crowding exists; or we have even more complicated conditions with an abnormal relationship of the jaws. The question is, then, will development occur or must some mechanical means be used to assist development? Here a thorough understanding is needed, and the best teacher is observation of the mouths of many children. Conditions vary so in the mouths of children that no set rule can be given as to when orthodontic means should be employed to correct abnormal development. I can suggest only that frequent observation be employed, and early correction be made.

THE CHILD'S FIRST VISIT

When a child is presented for treatment, we first ask his age. Diagnosis of the conditions present and the entire plan of treatment rest to quite an extent on the age. For instance, at the age of six, we know at once that deciduous molars must be saved if possible; but at the age of ten or eleven, it is not always necessary to save these teeth.

At the first visit, we outline, if possible, what is to be done with the case. The teeth to be saved and those to be extracted are charted carefully, and a definite procedure is planned for each successive visit. This will save much time later, for we will not have to stop and think at each visit, What shall I do next? Parents often ask how many visits will be required to do the work, and by this plan, we can give an approximate answer and make a number of appointments ahead. It is best to have two or three appointments a week and complete the work as quickly as possible. Temporary fillings do come out if left in too many days. It is difficult to keep all children away from sticky candy and gum.

At this first visit, time is taken to discuss thoroughly with the parent the condition of the child's mouth. This is an excellent opportunity to educate the parent. Parents are quite interested if one takes the time, with simple words, to discuss the child's dental condition, outlining what the future may be for the child's mouth if care is given. A closer association will be had with the parent, and the parent will have greater confidence in the dentist as an operator. At future visits, it will not be necessary to take so much time discussing what we are doing for the child because it has all been outlined at the beginning.

Children frequently come alone, or with a nurse, after the first visit, and the parent is often not seen again for many months. The parent has placed the responsibility of caring for the child in our hands and expects us to do what is needed.

Every operator should have a recall system, and this should be explained to parents. Many will appreciate being notified. If a child has been somewhat un-

happy about the visits, often a card addressed to him will make him feel more interested in returning. We should try to have this return visit a very pleasant one, even if another appointment is necessary in a few weeks.

The technics used in children's work must be simple to be practical, and to be profitable must consume very little time.

When children come in with a toothache, the cause must first be determined. A toothache may result from food packing between broken down proximal cavities or the presence of an exposed pulp or a non-vital tooth with infection developing. In instances of cavities or pulp exposures, carbolized resin is useful. The débris is removed and most of the decay, with as little pain as possible. One side of a cotton pellet the size of the cavity or two approximating cavities is dipped in the carbolized resin, the cavity is dried and the resin side is placed in the cavity or cavities. This acts as a sedative to the irritated pulp, and the expansion of the cotton as it becomes moist pushes away the gum tissue from the gingival margins. When the patient returns in from one to two days, the tooth is less sensitive, and there is ready access to the cavity. Whatever treatment is necessary, a filling to restore the carious area or a pulp treatment, if the pulp is exposed, is then given.

If the toothache is caused by a non-vital pulp, the pulp chamber is washed and cleaned out thoroughly and left open to drain; or, if a mild state of infection is present, a treatment is sealed in. At this visit, a roentgenographic examination should be made. The patient should be seen the next day, and after study of the roentgenogram and consideration of the health of the patient, the operator determines whether it is advisable to save or to extract the tooth.

CAVITY PREPARATION

In preparing cavities, a definite preparation can be made with little pain if sharp burs and sharp instruments are used. When a proximal surface is involved, a step preparation must always be made, and with the usual areas where the horns of the pulp extend in mind. Occasionally, if the proximal surface of a molar has only a small carious area, and there is easy access to the molar, a simple preparation can be made without breaking down the marginal ridge. Undercuts must be made for retention. This procedure is quite practical if, for instance, the mesial surface of a second deciduous molar is involved and there is a large distal cavity in the first deciduous molar. A definite, finished preparation should always be made, never a half-way one. We are sometimes tempted to be careless, especially when the patient is restless. Insufficient work in children's dentistry results in pain for the patient, difficult "do over" work for the dentist and loss of confidence of parents in the necessity of having children's teeth cared for. All cavities in deciduous teeth should be filled. It may be time for a tooth to be lost, but teeth do not always come out when expected. If a tooth is left in and not cared for, the cavity collects débris and there is a tendency for the adjacent tooth to become carious. All teeth that cannot be properly treated and filled should be removed.

COPPER AMALGAM

As filling material for deciduous teeth, copper amalgam is most useful, economical and practical. I admit that it is not very beautiful in the mouth; but what piece of repair work is ever very lovely? It does take a long time to set, but, once set, it is usually there for the life of the tooth. The enamel of the deciduous teeth is quite brittle as compared to the enamel of the permanent teeth and often will chip away from the margins of a filling, leaving an area in which caries will recur. When copper amalgam is used as a filling material, enough copper salts is deposited that caries seldom recurs on a broken margin.

Once the use of copper amalgam is mastered, it is not difficult to place. First, the cavity must have a preparation with sufficient retention. A matrix must be used on all two-surface fillings to insure a smooth finish at the gingival line. Second, the copper amalgam must be thoroughly mixed and then the excess mercury expressed through a napkin with pliers. Seldom is it placed too dry. The amalgam is packed thoroughly into all parts of the cavity to insure retention. Third, the filling must have a broad contact with the adjacent tooth. Copper amalgam has a tendency to wash, and if a point contact is made, there is soon a space between the teeth where food will pack. Fourth, the patient must have only liquid or puréed food for the remainder of the day. This fact must be impressed on the child and on the parent, and their cooperation be requested.

The patient can be dismissed as soon as the filling is placed and the matrix removed. Thus, no time is wasted waiting for the amalgam to set, as this does not occur for many hours. Practically no polishing is required at the next visit, except to make certain there are no rough surfaces or overhanging gingival margins. The filling does turn black, and to this some parents object; but the merits of the material exceed this esthetic objection.

The breaking out of copper amalgam fillings is due to faulty preparation of the cavity or improper mixing or packing of the amalgam when it is too soft, or to mastication before sufficient setting time has passed.

Silver amalgam does have a place in children's dentistry. It is used where a point contact is desired, as on the distal surface of the second deciduous molar. Here, we must do everything possible to protect the mesial surface of the first permanent molar.

Gold inlays can be and are being used in deciduous teeth. From an economic standpoint and for many practical reasons, the amalgams suffice in deciduous teeth.

As important as cavity preparation and filling materials in the care of deciduous teeth is root canal treatment. In preparing cavities in deciduous teeth, all decay must be removed even if the pulp is exposed. It is far better to expose the pulp than to leave carious areas. The tubuli of the dentin in deciduous teeth are so large that infection is often carried to the pulp before a definite exposure is found. If there is a possibility that infection has reached the pulp, though no large exposure can be found, it is advisable to remove the pulp before much infection can develop. In my experience, the so-called capping of deciduous pulps results ultimately in the death of the pulp and a sequence of infection which usually results in the loss of the tooth. Since no space maintainer can fully take the place and function of the tooth, something must be done to keep teeth that are pulpless in a healthy condition.

ROOT-CANAL TECHNIC

The root-canal technic which follows is very much like the technic of M. Evangeline Jordon, published in her book on "Children's Dentistry."

One of the outstanding merits of this technic is that each treatment requires only a few minutes, and as there are usually a number of cavities to fill, a tooth can be treated and one or more teeth can be filled at each visit. In this way, when the treatments are finished, the work in the entire mouth is completed.

The technic of treating exposed pulps of deciduous teeth is as follows. A roentgenogram is a prerequisite in the treatment.

1. At the first visit, the cavity is cleaned of débris and as much decay as possible is removed without giving too much pain. If sharp spoons are used and care is taken not to press toward the pulp, much carious matter can be painlessly removed. A sedative treatment is placed until the next

day, or two days later. For a sedative treatment, carbolized resin on cotton is useful. Eugenol on cotton can also be used. A small pellet of cotton is moistened with eugenol, placed over the exposure and sealed with a temporary cement.

2. At the second visit, the tooth is ready for the devitalization treatment. The sedative is removed and the pulp examined for vitality. Often the pulp dies under the sedative treatment. It was perhaps about to die. If vitality is present, the devitalizing agent, a disk containing one-fiftieth grain of arsenic and a small amount of procaine is placed. Only a small portion of the disk is needed. It is placed directly over the exposed area after being moistened in eugenol. The disk is sealed in with a temporary cement and should be left no longer than from twenty-four to forty-eight hours. If it is left for a longer time, the tooth becomes very sensitive.

3. At the third visit, the disk, the remaining decayed matter and the pulp tissue in the pulp chamber are removed. The tissue in the canals is removed with spoons and explorers, but no broaching of the canals is done. A pellet of cotton moistened with formocresol is sealed in from two to three days with gutta-percha.

4. At the fouth visit, the formocresol treatment is repeated. It is not always possible to clean the pulp chamber thoroughly the first time.

5. At the fifth visit, the tooth is ready for filling. Cotton rolls or napkins are used to isolate the tooth before the last formocresol is removed. Removal is easy as it has been sealed with gutta-percha. Alum paste is packed in the canals and pushed down with gutta-percha, which fills the pulp chamber. A sufficient amount for a step may be allowed to remain, or cement over the gutta-percha may be used for a step. The amalgam filling can be placed at this visit.

The alum paste which is used as a canal filling is a mixture of equal parts of alum, thymol, glycerine and calcium phosphate, sufficient to make a paste. The alum acts as a mummifying agent on the filaments of pulp tissue left in the apical portion of the canals. When the period of exfoliation approaches, normal resorption of the roots occurs and the tooth is lost in the normal manner.

When a pulp becomes putrescent, the procedure is as follows: The tooth is opened and all débris removed. The pulp chamber is thoroughly opened and washed with warm water. The cavity may be allowed to remain open for a day, or it may be treated with formocresol. The roentgenogram is studied and if resorption of the roots has not occurred to any extent, nor has any great destruction of tissue taken place, it is usually possible to save the tooth.

The health of the child must be considered before attempting to save a tooth with much infection. A history of the child's health is taken. If the child has spent a sleepless night, he may look very ill, but is not actually so. Relief from toothache and a good night's rest will restore him to his usual good health.

In treating such teeth, not more than two or three treatments of formocresol are needed. If more are needed, the prognosis is unfavorable. Alum paste is used for filling the canals as used for teeth with exposed pulps.

Non-vital deciduous teeth with fistulae present should not be treated unless the condition is acute. Chronically abscessed deciduous teeth do not respond readily to treatment. There is too much danger of undermining the health of the child in allowing such a non-vital tooth to remain. Space maintainers, if needed, hold the space until the eruption of the permanent tooth.

CARE OF THE FIRST PERMANENT MOLAR

The first permanent molar is a problem in the care of children. It cannot be treated as a tooth might be in the mouth of an adult until the child is past twelve years. Calcification of this molar begins

before the birth of the child and the entire formation of the tooth is not completed until the child is between ten and twelve years. It is very common to find faults in the developmental grooves and fissures with caries developing early after eruption. Preventive measures must begin with advice to the expectant mother during the prenatal period followed by intelligent care as regards the health and nutrition of the child. Every child's mouth should be prepared for the eruption of these molars. All deciduous teeth should be in a sound condition so that these molars will erupt in a mouth that is in a healthy condition.

All grooves which show the first signs of weakness should be opened and filled. The buccal and lingual pits of the molar are often found to be quite deficient in formation on eruption. If caries has progressed, all carious matter must be removed. The cavity should be sterilized, the pulp protected with a lining and a filling placed. We cannot be too conscientious in our care of these teeth. The material used for filling these molars may be gold or amalgam. In very small groove fillings, gold foil can be used when the patient is near ten years of age. For younger children, silver amalgam is generally used. In large cavities, gold inlays or silver amalgam fillings are used. The cements wash out too rapidly to be of any great value.

When the pulp of a molar becomes exposed before the apices of the root are fully closed, root-canal treatment is usually unsuccessful. Pulp amputation has been found successful, but should be used only in selected cases. In selecting such cases for pulp amputation, the pulp must be vital, with no infection present, and the patient one who can be easily controlled. The tooth must then be watched closely for trouble. At the least indication of infection, extraction is indicated.

For non-vital first permanent molars with open root apices, extraction is the only course. It seems tragic that children must lose permanent teeth so early in life, but it is the only way to safeguard their health.

FRACTURED INCISORS

The problem of broken incisors is a frequent one for children's dentists. First, a roentgenogram is made to determine whether there has been a fracture of the root. If the root is fractured, extraction is necessary. A mechanical maintainer must be provided to hold the space until development is complete; at which time, a more permanent appliance can be made. When the crowns of incisors are slightly broken and the pulp is not exposed, the exposed dentin should be protected from air and saliva at once. A band to fit the incisor can be quickly made, pinched together at the incisal edge and soldered. The band is then filled with zinc oxide and eugenol and placed over the incisor until a more permanent restoration can be made. A broken incisor should be restored to its normal form whenever possible.

Broken incisors with exposed pulps can be saved from extraction by amputation of the coronal portion of the pulp. Whenever there is a possibility of the pulp of a fractured incisor dying, it is desirable to perform a pulp amputation before infection has advanced.

When incisors with non-vital pulps and with the apices of the roots still undeveloped are broken, every effort must be made to save them. These teeth are needed for the normal development of the child's face. The loss of even one incisor is a serious handicap to the child. With great care, the infectious condition can usually be cleared up and a root filling placed. Such teeth need constant watching.

PULP AMPUTATION

The technic for pulp amputation is as follows: After the tooth has been anesthetized, it is isolated with the rubber dam and the area sterilized by wiping

with alcohol. The roof of the pulp chamber is removed. A large round bur is used to remove the pulp tissue in the pulp chamber and down the canal about 1 mm. The hemorrhage is controlled by wiping the stump of pulp tissue left with formocresol until the bleeding has stopped and there is no clot. A thick paste of formocresol and calcium phosphate is laid over the pulp stump. With a No. 34 inverted cone bur, a ditch is made in the dentin above the mixture of calcium phosphate to give retention to the cement which is to be placed. Too much pressure from the cement filling on the pulp tissue is to be avoided. The root apices in the process of development close very much as if the tooth were fully vital.

In summing up these various phases of children's practice, we have, first, the fundamental principles of dentistry with their application to children's dentistry and, second, a few practical methods useful in caring for the conditions found in children's mouths. We must now consider the subject from the standpoint of the personal relation between the child and the operator.

RELATION OF OPERATOR AND CHILD

If it has been one's privilege to be a member of a large family or to have had the association of children, he is somewhat better prepared to handle children than is the operator who knows nothing about them.

Once a student came to me and asked for assistance in caring for a child. He said his patient had the "jitters." I went to his chair and there was a little girl of about eight years. After working a bit and then watching him work, I found the child only normally restless. I asked the student if he came from a large family, and learned that he was an only child, and that he had had in the past few years no association with children. In a few months, with assistance, he became able to care for children very nicely and learned to like the work.

We cannot expect a child to sit perfectly still for any great length of time. We must be prepared at all times for a sudden movement and a certain amount of restlessness. However, I do believe that we can so train our little patients that, in time, many will become very responsive and realize that if they are quiet, the work can be done more quickly and with less discomfort. The operator must have a sincere interest in children and their welfare. He must have tolerance and patience and must be ready to show the necessary amount of sympathy when there is pain.

Mentally place yourself in the child's position. Look back a few years and recall how you felt when there was something new and rather fearful to meet. I have observed that small people can get along with children better than large people, who perhaps give the children a feeling of being overpowered. I have felt so myself when meeting a very large person. If I wish to talk seriously with a child, I often kneel or lean down to his height or, if the child is very tiny, place him on a chair. In this way, there is direct vision for the child and not the strain of looking upward. As little fuss as possible should be made in greeting the child; and one should be no more cordial than with an adult. Too much talk makes the apprehensive child feel that you are trying to cover up something.

Shall the parent be allowed in the room? This is a question that must be individually met. Children are nearly always more responsible and responsive when alone with you; but to the fearful, timid, shrinking child the parent's presence gives a feeling of security. After a few visits, it is well to try to work without the parent in the room. With some children, it makes no difference whether the parent is in the room.

For the stubborn, rebellious type of child who is head of the house at home, many hours are needed before he will submit to your authority. Always keep

control of yourself no matter how provoked you may become. Be firm, but with sincerity and kindness, in dealing with the child. In time, he will meet your demands and have the utmost respect for you.

Children, to be happy, must have the feeling of security. They can have this feeling only when the operator has confidence in himself, and confidence that he can help the child. Some children need only the atmosphere of security; others need more material assurance of it. I recall one instance when a child was very restless and feared every move made, but when at last held securely in the chair, relaxed and made no further resistance. He remarked, "If you will always hold me tight, I'll be quiet." He needed the assistance of a material form of security.

The "towel method" for controlling difficult children is quite successful and is used by many operators. When a child refuses to allow you to work, a folded towel is placed over his mouth and is held securely with one hand while the hands are held with the other. In a quiet, firm voice, the child is told that the towel will be removed when he decides to behave. In time, the child will relax and allow you to proceed. The longest time that the "towel method" has been made use of was forty-five minutes with a four-year-old child. Never again was she unmanageable. For the ten years that she was a patient, we were always good friends.

Children become quite interested and responsible in the care of the mouth if the subject is properly presented to them. Discuss with the child what you are doing and why. Instruct him in the daily care of his mouth and praise him if he is making progress. It is a good plan to instruct the child in the proper method of brushing his teeth each time we clean his teeth.

Also discuss nutrition with him. Bring it up quite casually, never letting him know if the parent has requested it. Ask what he had for breakfast and, if you feel it is inadequate, suggest that he either eat more or learn to like more wholesome food. Sometimes ask what foods he dislikes and why he dislikes them. Often the objection is to the form in which the food is presented and not to the food itself. Eggs are often distasteful to a child because they are served too soft, but in an omelet will be relished. Children will freely discuss these problems with you when they will not do so with their parents.

Children's dentists can be of vital assistance in helping children to overcome habits. Nail-biting can be discouraged from the standpoint that the edges of the teeth may become chipped if it is continued. Also, it may be suggested to the parent that the nails be well lubricated at night with oil, and when the dryness is relieved, there is not the tendency to biting.

These things may seem far from dentistry, but if one is to work for children, one must be interested in their welfare.

Luther Burbank, in commenting on child welfare several years ago, said, "If we had paid no more attention to our plants than we have to our children, we would be living in a jungle of weeds."

The children of our country need our help. Let us give all that we can to them.

135 Stockton Street.

INCIDENCE OF DRY SOCKET

By HAROLD W. KROGH, D.D.S., Washington, D. C.

THIS study was undertaken in an attempt to clarify the subject of dry socket. Dental literature has much to say of dry sockets and reports a few short series of selected cases; but, to my knowledge, no report of a series of consecutive extractions over a moderately long period of time has been published. By the publication of this and similar studies, we shall be able to test our opinions and perhaps eliminate this troublesome sequel to dental surgery.

The term dry socket as used in this report is intended to mean a socket in which the blood clot disintegrates, with the production of a foul odor, without pus formation and accompanied by a severe neuralgia of one or more branches of the fifth cranial nerve, persisting over a period of days.

The work reported here covers a period of approximately six years, from the summer of 1929 to the fall of 1936. There were 6,403 teeth removed from 2,110 patients. The cases were routine and consecutive tooth extraction only and were all handled in my office. Patients operated on in clinics, hospitals and schools could not be followed up and therefore are not included. Roots were considered as teeth, for we are here concerned with the healing of sockets only. Deciduous teeth were, of course, not included. Procaine was the anesthetic used in all cases. The teeth were not considered in relation to their vitality; neither were they grouped according to the systemic diseases from which some of the patients were suffering. Unfortunately, the cases could not be studied by age groups because it still seems impolitic for the dental surgeon to ask the age of his patients. In 4,043 teeth, simple extraction was performed, and 2,007 were removed surgically. Nearly all of the 353 impacted teeth had some degree of surgical preparation. By simple extraction, I mean the removal of the tooth by forceps or elevators without reflection of the soft tissues and resection of alveolar bone. The surgical technic was in the manner of Gardner and Austin,[1] consisting in removing a sufficient part of the buccal or labial alveolar bone in order (1) to reduce the force necessary to deliver the tooth, (2) to expose the apical pathologic areas, (3) to protect the adjacent teeth or (4) to eliminate undercuts which would interfere with the placement of dentures. The tooth is then delivered in the direction of the resected bone without luxation. This technic greatly reduces trauma and supplies the clot with blood from soft tissue.

The majority of the teeth were removed when the patients presented themselves, but many received prophylactic treatment prior to operation and a comparatively small number of patients had rather careful reduction of oral bacteria preceding the operation. The last group will be reported at a later date.

An attempt was made in all cases to work in a field uncontaminated by saliva, with the wound walled off until the socket filled with blood. The patient was then dismissed, the wound having been covered with a dry piece of gauze to be removed

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on reaching home or in approximately twenty minutes.

All cases received the same postoperative instruction; that is, to apply an ice-bag to the face for from four to six hours after operation; to avoid the use of mouthwashes until the next morning, and to take a mild laxative at bedtime. The use three or four times a day, for the following few days, of warm hypertonic saline solution rinses was advised. Patients returned for postoperative treatment until normal healing was assured or until painful symptoms had subsided.

Immediately after every extraction, two antagonistic forces became operative: the first, an effort of the body to organize the clot; the second, an effort of the mouth

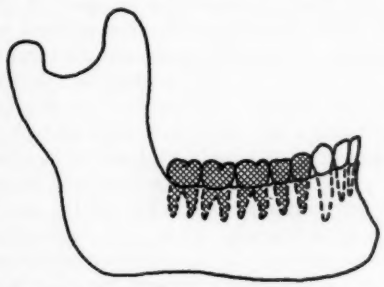

Fig. 1.—Anatomic location of 95 per cent of dry sockets.

bacteria to destroy it. If the clot is organized, normal healing results; if the clot is not organized or bacteria destroy it, a dry socket may result.

The effort of the body which concerns us is the formation of a circulatory system within the clot. The many subsequent changes in the clot leading to true bone formation are not pertinent to the subject of this paper. The sources of available regenerative blood-vessel tissue, that is, the endothelial cells, are found in the periodontal membrane, the canaliculi of the socket wall and the soft tissue at the mouth of the socket. This study showed that any force which depletes the source of endothelial cells retards normal healing and fosters the development of a dry socket. Such forces are exerted during the extraction of every tooth. It should be the aim of the dental surgeon to minimize them.

Conditions favorable or unfavorable to the life of the clot may be produced by two agencies: the body and the dental surgeon. Let us first consider Nature's methods. There are two main types of reaction in the bone around the roots of teeth, one a rarefying effect, the other a condensing. The rarefying reaction is favorable to postextraction healing; whereas, the condensing reaction is unfavorable. The former produces decalcifying changes with marrow spaces larger than normal; whereas, the latter causes the bone to become more highly calcified with marrow spaces smaller than normal. The first condition seems to increase the blood supply and the second to decrease it.

During coagulation, the clot shrinks. Sometimes, it pulls away from the bony socket and cuts itself off from its blood supply, which may also permit the ingress of bacteria. In either case, the clot may be destroyed. The coagulating blood, in sockets of pyorrheic or surgically removed teeth, pulls the soft tissue with it as it shrinks, this keeping the socket sealed and preserving a source of blood supply.

Healing is usually rapid and painless after the removal of pyorrheic teeth because of the character of the tissues supporting these teeth and the lack of extraction trauma. Such teeth have thickened periodontal membranes, a reduced depth of bony socket and a partial soft tissue socket wall. The reduced depth of the bony socket and the thickened periodontal membrane make for extraction with the minimum of trauma. The partial soft tissue socket wall plus the thickened periodontal membrane insures an abundant blood supply to the clot.

The condensing type, on the other hand, makes a more unyielding socket wall; which necessitates greater force to remove the tooth and transmits greater

trauma to the periodontal membrane and socket walls. In addition, the periodontal membrane becomes thinner and tends to become atrophic. Under these conditions, the probability of dry socket development is markedly increased.

Another unfavorable reaction of the body is the formation of additional layers of cementum on the roots in such pattern as to alter their normal taper. The injury to the periodontal membrane and socket wall during the forcible extraction of excementosed teeth is considerable. The dental surgeon may increase the likelihood of normal healing by preparing an opening through which the altered roots can be delivered.

greatly aid Nature by surgically removing the teeth.

I shall now present the data accumulated from a review of the cases operated on during these six years.

In Table 1, the term "operation" as I use it needs clarifying. An operation is an extraction of one or more teeth at a single sitting. The same patient may, of course, have several teeth extracted. The removal of several at one sitting constitutes a single operation; at three sittings, three operations. Thus, the number of operations is not the same as the number of teeth removed or the number of patients operated on. Impacted teeth are those which were completely impacted.

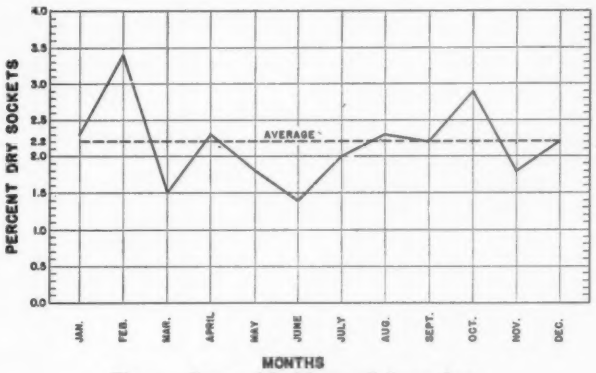

Fig. 2.—Seasonal incidence of dry sockets.

Many of the conditions which influence the postoperative course can be ascertained prior to the removal of teeth by a careful study of the roentgenograms and by clinical examination. The position, size and shape of the roots, evidence of apical pathologic changes and the thickness of the periodontal membrane, as well as the structure of the bone, can be detected in the roentgenograms. The condition of the supporting soft tissues and the functional state of the teeth are learned through the clinical examination. For reasons stated above, when the preoperative findings appear to be unfavorable to normal postoperative healing, the dental surgeon can

I have not differentiated between unerupted and impacted teeth.

The data in Table 2 do not mean that 41.3 per cent of the males and 58.7 per cent of the females operated on developed dry sockets. The first figures, 43.5 per cent males and 56.5 per cent females, refer to the percentage of the total number of patients. Of the 6,403 teeth removed, 138 developed dry sockets. Of these 138, 41.3 per cent were in males and 58.7 per cent were in females. Comparing these figures with the percentage total, one sees that males and females are equally susceptible to dry socket.

Of a total of seventy-five dry sockets

following the removal of erupted teeth, only six occurred in the upper jaw; whereas, sixty-nine occurred in the lower jaw. (Table 3.) Attention is invited to the fact that 91 per cent of dry sockets were located in the lower bicuspids and molars.

TABLE 1.—GENERAL DATA

Patients	2,110
Male	917
Female	1,193
Operations	3,592
Teeth extracted	6,403
Erupted, upper	3,586
Lower	2,464
Impacted, upper	88
Lower	117
Partially impacted	
Upper	32
Lower	116

TABLE 2.—SEX INCIDENCE

Sex	Operations Per Cent	Dry Sockets Per Cent
Males	43.5	41.3
Females	56.5	58.7

TABLE 3.—LOCATION OF DRY SOCKETS

Erupted Teeth	
Upper second bicuspid	3
First molar	1
Third molar	2
Lower cuspid	1
First bicuspid	5
Second bicuspid	8
First molar	19
Second molar	23
Third molar	13
Total	75

As indicated in Table 4, the occurrence of dry socket in the upper and lower jaws following the removal of impacted teeth is relatively the same as for erupted teeth.

Figure 1 illustrates in a different manner the location of the majority of dry sockets and suggests several significant facts. Of a total of 138 dry sockets, only seven occurred in the upper jaws; whereas 131 occurred in the lower jaw. Moreover, 95 per cent of all dry sockets were found in the lower bicuspid and molar regions. These figures include both erupted and impacted teeth. It seems evident that this is the region which should receive special study in the effort at solution of

TABLE 4.—LOCATION OF DRY SOCKETS

Impacted or Unerupted Teeth	
Complete Impactions	
Upper	0
Lower third molar	32
Partial Impactions	
Upper third molar	1
Lower third molar	30
Total	63

TABLE 5.—LOCATION OF PARTIALLY DRY SOCKETS

Erupted Teeth	
Upper Cuspid	2
Second bicuspid	1
First molar	1
Second molar	1
Lower lateral	1
First bicuspid	3
Second bicuspid	6
First molar	8
Second molar	9
Third molar	6
Total	38

TABLE 6.—LOCATION OF PARTIALLY DRY SOCKETS

Impacted or Unerupted Teeth	
Complete Impactions	
Upper	0
Lower third molar	4
Partial Impactions	
Upper third molar	1
Lower third molar	4
Total	9

the dry socket problem. This evidence also tends to disprove the frequently stated theory that infiltration anesthesia is an important cause of dry sockets; for these teeth are almost always blocked and not infiltrated.

By the term "partially dry socket," I mean that the entire clot did not disintegrate and that, after one or two treatments, normal healing was resumed. (Tables 5-6.) Whether prompt therapeusis was responsible is a matter for speculation. It is interesting to note that the location of the partially dry sockets is the same as that of the completely dry sockets.

Percentages were computed on a monthly basis to determine the possibility of a seasonal influence. (Fig. 2.) As dry sockets have the habit of coming in groups, many times without apparent reason, it is natural that dentists sometimes ascribe their bad luck to the weather. The six-year dry socket average of 2.2 per cent was used as the base line and the monthly percentages plotted against it. Although the curve seemed to vary greatly from month to month, the greatest departure from the base line was only 1.2 per cent. So it may safely be said that the seasons do not influence dry socket incidence.

TABLE 7.—PERCENTAGE OF NORMAL HEALING AND DRY SOCKET IN RELATION TO DIFFICULTY OF REMOVAL

Difficulty of Removal Grade	Total Operations	Operations Followed by Normal Healing		Operations Resulting in Dry Socket	
		Number	Per Cent of Total	Number	Per Cent of Total
I	1,857	1,844	99.3	13	0.7
II	1,388	1,326	95.5	62	4.5
III	330	279	84.6	51	15.4
IV	17	13	76.5	4	23.5

Table 7 classifies operations according to mechanical difficulty, Grade I representing the teeth easiest to remove and Grade IV those most difficult to remove. Of the operations, 53.2 per cent were on Grade I teeth, and of these, in only thirteen, or 0.7 per cent, did dry socket develop. In Grade IV, those most difficult to remove, 23.5 per cent developed dry sockets. Thus we see that as the operations increase in difficulty, the percentage of dry sockets increases.

The figures in Table 8 represent the postoperative day when treatment of the socket was begun. The figures in bold type indicate that 71.7 per cent of the dry sockets begin on the second or third day. The majority of those beginning later follow the removal of impacted teeth.

Table 9 indicates the last postoperative day on which the socket was treated. The dry socket symptoms of the large majority subsided the tenth day. In the few who

lingered longer, impacted teeth had been removed and the condition may have been complicated by my failure to anticipate and remove all hopelessly traumatized bone.

Treatment consisted of gently flushing the socket with warm hypertonic saline solution and then lightly inserting in the socket a strip of gauze impregnated with one of the following drugs: Conducto,* Stopain,† guaiacol and glycerin, iodine and eugenol, acetyl salicylic acid and guaiacol, and eugenol. Dressings were changed every day in most sockets and twice daily in some severe cases. In no case were the walls of the socket curetted in an attempt to promote new clot formation. Of the various drugs used to alleviate, Conducto, a trade preparation; guaiacol and glycerin, and eugenol were used most frequently. The remaining drugs were used in only a few cases. There is little choice among these drugs. This conclusion has likewise been reached by Claflin working in the Research Department of the Chicago College of Dental Surgery.[2] None of them shortened the treatment time and all sometimes provided too short a period of relief from pain. Many of the sockets were irradiated with ultraviolet light, some immediately after extraction and others during the course of treatment. No beneficial effect was noted.

Table 10 gives the concentration of the vasoconstricting agent in the various kinds of procaine used in this series.

The relation of multiple extractions to dry sockets is significant and instructive. In this series, only eleven sockets of 138 developed in which an adjacent tooth was removed at the same operation, and in

Table 8.—Day of Onset of Symptoms

Day After Extraction	No. of Sockets Showing Symptoms
First	6
Second	**50**
Third	**49**
Fourth	17
Fifth	9
Sixth	5
Seventh	2
Total	138

Table 9.—Day of Last Treatment

Day	Number of Sockets
Fourth	1
Fifth	5
Sixth	11
Seventh	**27**
Eighth	**30**
Ninth	**26**
Tenth	**19**
Eleventh	8
Twelfth	4
Thirteenth	3
Fourteenth	1
Fifteenth	1
Sixteenth	2
Total	138

Table 10.—Types of Novocain Used in This Series

Type	Concentration	Gm./Cc.
Metz "E"	1-20,000	0.00005
Metz "T"	1-50,000	0.00002
Abbott's Procaine No. 2	1-25,000	0.00004
Metz "K"	1-65,000	0.000015
Cook's "A"	1-50,000	0.00002
Cobefrin-Cook		

*Not accepted for A.D.R.

†Not accepted for A.D.R. (J.A.D.A., 21:220, December 1934).

two of these cases one of the teeth was impacted. In only two cases were two adjacent sockets dry simultaneously, and in only one case were three adjacent sockets dry. Thus, only eighteen of a total of 138 occurred in which an adjacent tooth was removed in the same operation. If there are several adjacent teeth to be removed, particularly in the lower jaw, the best postoperative healing will follow removal at one operation—one more argument against piecemeal extraction.

Table 11 shows the location and number, with percentages, of dry sockets from impacted teeth. It will be seen that the upper dry sockets are practically negligible and that there is a very high incidence in the lower third molar region. This incidence is entirely too high. The additional trauma incident to their removal and the infection under some of the gum flaps may be a partial explanation. Kronfeld[8] has shown that the periodontal membrane around impacted teeth is much thinner and in some cases is replaced by fatty tissue. It follows, then, that the available blood supply to the clot is greatly diminished. The high percentage of dry socket following the removal of impacted teeth brings up an interesting

TABLE 11.—INCIDENCE OF DRY SOCKETS

Impacted or Unerupted Teeth			
Location	No. of Teeth	No. Dry Sockets	Dry Sockets Per Cent
Complete impactions			
Upper third molar	83	0	0.0
Lower third molar	112	32	28.7
Partial impactions			
Upper third molar	30	1	3.3
Lower third molar	113	30	26.5
Totals	338	63	18.6

TABLE 12.—INCIDENCE OF DRY SOCKETS

Erupted Teeth			
Location	No. of Teeth	No. Dry Sockets	Dry Sockets Per Cent
Upper Central	393	0	0.0
Lateral	395	0	0.0
Cuspid	353	0	0.0
First bicuspid	465	0	0.0
Second bicuspid	472	3	0.8
First molar	525	1	0.2
Second molar	500	0	0.0
Third molar	483	2	0.4
Lower Central	205	0	0.0
Lateral	202	0	0.0
Cuspid	156	1	0.6
First bicuspid	241	5	2.2
Second bicuspid	371	8	2.2
First molar	453	19	4.2
Second molar	460	23	5.0
Third molar	376	13	3.5
Totals	6050	75	1.2

point. The statement is often made in dental literature that the infection in the bone around the root ends of pulpless teeth is a cause of dry socket. Since impacted teeth are vital, with a dry socket incidence of 18.6 per cent in this study, as against an incidence of 1.2 per cent for erupted teeth, only part of which were pulpless, the rôle played by such infection must be a minor one. Fortunately for dental surgeons, the public expects considerable trouble after the removal of impacted teeth.

Table 12 summarizes the number, locations and percentages of erupted teeth and dry sockets. The figures indicating the lower bicuspids and molars are in bold type. It will be seen that the highest percentage (5) occurred in the lower second molar sockets. The average percentage of dry sockets following the removal of 6,050 erupted teeth was only 1.2.

One of every forty-six teeth developed a dry socket. One of every seventeen patients was so afflicted. This seems a very high proportion, but consideration must be given the fact that the patients were operated on over a six-year period, many having several operations. One of every five and one-half impacted teeth developed a dry socket. This is a discouraging figure. However, of the erupted teeth, only one of every seventy-nine and one-third developed a dry socket.

SUMMARY

1. The conclusions here presented are based on the experience of removing 6,403 teeth over a period of six years.

2. All teeth were removed under procaine anesthesia.

3. One hundred thirty-eight dry sockets developed in 130 patients, 1.2 per cent from erupted teeth and 2.2 per cent from all types.

4. Male and female were equally susceptible.

5. Ninety-five per cent of the dry sockets occurred in the lower bicuspid and molar sockets.

6. There was a definite correlation between the mechanical difficulty of tooth removal and dry socket incidence.

7. There was no appreciable seasonal variation.

8. In 71.7 per cent of cases, treatment was begun on the second or third day.

9. In 73.9 per cent of cases, treatment was ended between the seventh and tenth day.

10. None of the drugs used shortened the treatment time nor did they always satisfactorily relieve symptoms.

11. Infiltration anesthesia is not a cause of dry sockets.

12. The more adjacent teeth removed at one operation, the less the danger of dry socket development.

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THE SURGICAL CORRECTION OF PROGNATHISM

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FOR several years, I have used a surgical procedure for the correction of extreme cases of prognathism that are not amenable to correction by orthodontic means. A preliminary report was made of this procedure by Dr. Walrath and me in 1932. Since that time, additional operations have been performed with successful results.

Fig. 1.—Prognathism (protruding chin). There is about five-eighths inch overriding of teeth in this case with the usual deformity of the facial profile. (Compare Figures 2-4.)

The procedure used is a modification of one of the operations which has been in vogue for ankylosis for many years, but which heretofore has not been used for the relief of prognathism.

In considering the average case of prognathism, the conspicuous observations are, first, that the size of the body of the mandible and the number of contained teeth correspond with the maxillae, the existing condition being that the body as a whole is set forward; and, second, that the angle of the mandible is abnormally obtuse, the body of the mandible, as a result, being set forward when the teeth are brought into occlusion.

Fig. 2.—Front view of patient shown in Figure 1.

The fundamental necessity involved is to create an additional angle farther back so as to counteract the ill effect of the obtuseness of the mandibular angle in throwing forward the structures of the body of the mandible when attempts are made to bring the teeth into occlusion.

As it would be a difficult procedure to correct the deformity at the angle itself, a technic was finally evolved to create another angle at the most accessible and

(Read before the Oregon State Dental Association, March 1936.)

smallest part of the ramus, which is the neck of the condyle, producing at this point a "set-back angle" or a "bow-back angle," to counteract the existing condition.

It has been found that very little backward bending of the neck is required to counteract the obtuseness of the angle, which throws the body of the mandible forward. By the postoperative fixation of the teeth in proper occlusion during the healing process, or the formation of the new counteracting angle, the degree and character of this "set-back angle" has the

Fig. 3.—Facial profile and apposition of teeth restored by construction of extra joint in each neck of mandible in case referred to in Figures 1-2.

Fig. 4.—Front view of patient in Figures 1-3; after restoration.

precision of a mechanical calculation and the exactness of "die casting."

Therefore, with these anatomic principles in mind, the first operation was performed a few years ago, with a good surgical result, and meeting with approval of the critical, scrutinizing orthodontists.

In performing this particular type of operation for ankylosis, fascia is placed between the two ends of the severed neck of the condyle, the piece of fascia growing firmly to each cut end of the severed piece of bone, and holding them firmly together, but, at the same time, giving the neck a flexibility analogous to that of the universal joint on the shaft of the automobile. This is necessary in order to overcome the immobility of the temporomandibular joint in cases of ankylosis.

In the execution of this technic for the correction of prognathism, it is not necessary to use the fascia, as no postoperative mobility of the type mentioned for ankylosis is necessary. A bony union may occur with the same good results, when the neck has a "bow-back angle" adequate to compensate for the obtuseness of the mandibular angle. With adequate fixation methods during the healing time and the proper medication to counteract any ill effects from muscle spasm, a good, firm union in the selected position will occur. There can be no danger of open bite resulting, because the normal length of the head and neck of the ramus is undisturbed and unchanged. The Dufourmentel operation, which consists of the

removal of the head and neck of the condyle, gives a possibility of an open bite, and, according to reports, the open bite has occurred in a considerable number of patients operated on by this method. Any intimation of the possibility of an open bite resulting from our procedure implies a lack of knowledge of the details of the operation and the anatomic structures.

The movements of the mandible by the pterygoid muscles have not been disturbed in any of our cases. There is no anatomic reason for such an interference as all movements can be accomplished by the muscles of mastication when the new angle is made a firm osseous union. By binding together the cut bone with fibrous tissue, end to end, an increased flexibility results, analogous to that of the universal joint of the automobile drive shaft, without any loss of function or risk of displacement. This principle has long been successfully applied for the relief of ankylosis.

Fig. 5.—Prognathism, single. There is one angle abnormally obtuse and the opposite side is normal, lateral protrusion resulting. (Compare Figures 6-8.)

The approach to the neck of the condyle is made by placing the skin incision in the temporal area, which is within the hair and therefore does not show. It is necessary to extend the posterior portion of the incision down in front of the ear for a short distance for adequate approach. Immediately in front of the ear is a crease in which the incision can be extended, and therefore the part of the scar which is beyond the hair line is practically invisible. In addition to avoiding the creation of a visible scar, the high approach is important in order to avoid any damage to the facial nerve. From the standpoint of a resultant scar, this operation has no disadvantage.

Fig. 6.—Front view of patient shown in Figure 5.

As it has no possibility of direct or indirect connection with the cavity of the mouth, there is no risk of infection from the oral cavity.

In cases of long standing, individual teeth may be found out of place, and it will be necessary, as a postoperative procedure, to move these into a more favorable position by orthodontic means.

There are certain general considera-

tions to be borne in mind in performing this type of operation:

1. The branch of the facial nerve supplying the orbicularis oculi muscle passes through the upper part of the parotid gland, emerging superficially at its anterior superior border, and from there passing forward and upward through superficial structures toward the area of its distribution. The anterior part of the incision therefore should be kept above the zygomatic process, and when the dissection is carried deeper, it should be on a plane with this bony process, thereby carrying all of the superficial tissues in the uncut flap. The severance of this branch will result in a permanent inability to close the eye. The approach can be made with safety if the tissues of the superficial structures including the parotid gland are untouched, and elevated in the flap.

2. The internal maxillary artery lies beneath the neck of the condyloid process, and it may chance to be immediately beyond the point of the bone which is to be cut through. The use of a sharp chisel in a lateral direction and the smoothing of rough edges with small rongeur forceps is a safe technic. The deep approach to the bone can be made by spreading the lower fibers of the capsular ligament, without destroying this portion of the ligament.

3. A temporary displacement of the upper fragment may ensue from spastic contraction of the external pterygoid muscle due to its forward pull on the neck, head and interarticular disk. Preoperative and postoperative administration of adequate anodynes, preferably morphine, entirely eliminates this contingency, in our experience.

4. The anesthetic is a matter of considerable importance, particularly from the standpoint of postoperative nausea and vomiting. This has to be given serious consideration, as it is necessary to maintain the upper and lower teeth in occlusion, following the operation, until the healing process is completed. The fixation method must be one in which the

Fig. 7.—Facial profile and apposition of teeth restored by construction of extra joint in neck of mandible on affected side. (Case referred to in Figures 5-6.)

Fig. 8.—Front view of patient in Figures 5-7; after restoration.

occlusion can be loosened in an emergency; which, however, will not be apt to arise if anesthetic methods are carefully selected. In the average adult cases, it is far better to perform this operation under block anesthesia of the maxillary and mandibular branches, plus local infiltration and preoperative medication with a large dose of a barbiturate and the customary hypodermic injection of morphine. Rectal anesthesia (ether) has proved very satisfactory. For a general inhalation anesthesia, nitrous oxide is the anesthetic of choice.

Fig. 9.—Prognathism (protruding chin). The lower teeth were over one-half inch beyond the upper, and the patient was unable to "bite a lead pencil." (Compare Figures 10-12.)

Fig. 10.—Profile view of patient in Figure 9.

5. The strictest aseptic technic of bone surgery should be followed here as in bone surgery of any other part of the body. Any danger of infection can be reduced to nil in the hands of a competent bone surgeon.

There are a few points of postoperative treatment which seem to make for a perfect result. Among these are:

1. Immobilization during the healing process is of utmost importance. This can be carried out (1) by direct wiring of the teeth, (2) by use of orthodontia bands with protruding pegs for wiring, or (3), what seems to be a better procedure, by use of the upper and lower plain round alinement arches placed prior to the operation, permitting speedy immobilization after the operation or an easy loosening of the jaws in case of postoperative vomiting.

2. If the technic of a typical arthroplasty is carried out, as when the operation is done for ankylosis, a fulcrum should be placed between the posterior molar teeth in order to maintain a protection from pressure necrosis of the interposed fascia.

3. If bony union is desired in this new "set-back" position, it is unnecessary to place a fulcrum between the posterior teeth. In fact, it would be a disadvantage, as it is desired to have the cut bone edges in close contact.

4. Postoperative anodynes are necessary for the first week at least to overcome muscle spasm of the external pterygoid, which might otherwise produce a poste-

rior displacement of the upper fragment. Proper anodynes will safely eliminate this risk. The amount and kind of anodyne must be in accordance with the age and weight of the patient. It seems best to use broken doses of morphine for the first two to four days, then codeine, then phenobarbital.

As compared with the other procedures heretofore employed for the correction of extreme cases of prognathism, the advantages of making the correction by either a movable or a fixed "bow-back" in the neck of the condyle may be summarized as follows:

1. There is no destruction of nerve and blood supply to the teeth.
2. No teeth are lost.
3. No wire or foreign material is left in the tissues.
4. No danger of devitalization of pulps of teeth.
5. No loss of sensation over the course of the mental nerve.
6. No danger of infection from a chance communication with the oral cavity.

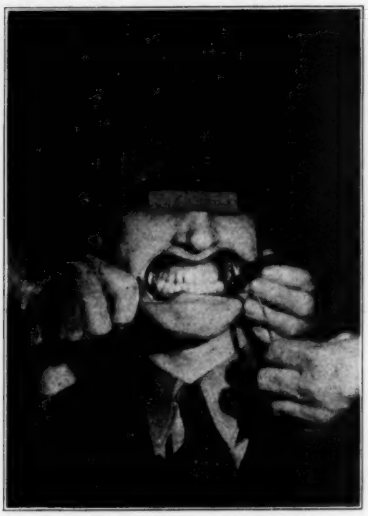

Fig. 11.—Facial profile and bite restored to normal in patient shown in Figures 9-10. An extra joint was formed in each neck of the mandible and the patient is now able to "bite a thread."

Fig. 12.—Profile view of patient in Figures 9-11; after reconstruction.

CONCLUSIONS

1. Cases of prognathism in which the lower teeth protrude a half-inch beyond the upper are not amenable to orthodontic correction.
2. Extreme cases of prognathism are amenable to correction by creating in the neck of the condyloid process a "bow-back angle," either fixed or movable, which will compensate for the abnormal obtuseness of the angle of the mandible.
3. Many of these cases of long standing will require postoperative orthodontic treatment of individual teeth to establish the occlusion of the lateral teeth.
4. As a number of operations of this type have been performed with universal success, it appears that this procedure should supplant former types of jaw resection.

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INFECTION OF GASSERIAN GANGLION FOLLOWING TOOTH EXTRACTION

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REPORT OF CASE

J. W., a white man, aged sixty-two, was admitted to the Buffalo City Hospital, January 5, 1937, with a diagnosis of alveolar abscess. Seven days before admission, his left cheek became swollen. The patient extracted his upper left central incisor three days later. Subsequently, the swelling became more pronounced.

On admission, the patient appeared acutely ill and had a temperature of 102°F. The left cheek presented an area of soft inflammatory swelling with a suggestion of fluctuation.

The swelling extended from the zygoma to the mandible and anteriorly to the corner of the mouth. On intra-oral examination, there was marked gingival sepsis with a slight bulging of the left buccal surface. Thick foul-smelling pus was draining from the upper left mucobuccal fold. The only other abnormal clinical finding was an elevated blood pressure of 160 systolic, 90 diastolic.

The following day the socket of the extracted tooth appeared to be healing normally and discharge from the left mucobuccal fold was no longer present. The external swelling persisted and there was an accompanying trismus. The patient was able to open his mouth only about half an inch. There was a swelling of the left periorbital tissues. The upper and lower lids were very edematous and there was marked conjunctival chemosis, especially at the outer angle. The right eye exhibited a slight degree of chemosis at the inner angle and excessive lacrimation. Fundus examination was impossible.

On the following day, both eyes were edematous and the conjunctivae were everted and injected, the chemosis being more marked. There was a bilateral proptosis. The swelling of the left cheek appeared to be subsiding. There were evening rises in temperature associated with chills. There were no signs of active dental disease present and surgical procedure was not indicated. Three days before death, the patient became unconscious and delirious. The periorbital swelling and redness were more prominent and herpes of the lips developed. It seemed probable that cavernous sinus thrombosis following thrombophlebitis of the facial veins had developed. The temperature rose gradually and the coma became more profound.

January 15, ten days after admission, the patient expired, with a terminal temperature of 106°F.

The leukocytes, January 11, numbered 27,750 per cubic millimeter with thirty-nine segmented forms, forty-four stab forms and one eosinophil. The chemical reactions of the blood were reported normal. A blood culture was not taken.

Necropsy.—An unusually extensive dissection of the head and neck was possible since the body was unclaimed and so reverted to the Anatomy Department, which kindly permitted necropsy. The pertinent findings are as follows: There were a number of pinhead-size serosanguinous crusts and vesicles in the skin of both lips. There was a marked bulging of the soft tissues of both orbits and a bluish red discoloration of the skin around the eyes. There was evidence of a recent extraction in the upper left central incisor region. Many teeth were missing and the remaining ones were markedly abraded. There was a moderate amount of dental caries and a few retained roots. The gingival tissues showed congestion and gingivitis. The left upper posterior wall of the pharynx bulged forward moderately.

(From the Departments of Dentistry and Pathology, Buffalo City Hospital, and the University of Buffalo Schools of Dentistry and Medicine.)

On dissection, a number of confluent abscesses were found in the soft tissues of the left cheek. The most superficial was in the region over the upper left cuspid. This abscess was about 1.5 cm. in diameter. The pus was a dirty grayish color and contained many gram-positive cocci of various sizes in short chains and clusters and some gram-negative diplococci. There were also gram-positive and gram-negative bacilli. A purulent sinus tract extended from this abscess to one in the infratemporal fossa. The latter abscess was ovoid, 4 cm. in its greatest diameter, and contained pus similar in character to that seen in the superficial abscesses. Its lining was shaggy, moderately firm and cream-colored. Its walls varied from 1 to 3 mm. in thickness. Remnants of nerves and vessels "bridged" the abscess cavity in a fashion not unlike that seen in some tuberculous cavities.

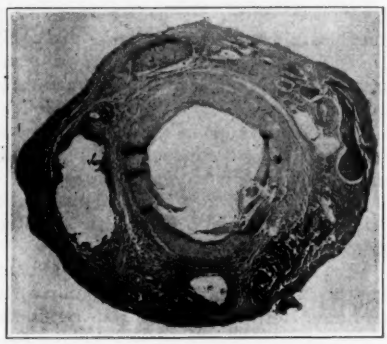

Fig. 1.—Section of internal carotid artery. (×32.) Some thrombus is attached to the intima. Most of the thrombus has been lost through an artefact. Three distinct abscesses can be seen in the adventitia and media.

The abscess was bounded anteriorly by the tuberosity of the maxilla, the posterior wall and related structures of the pharynx, and medially by the outer pterygoid lamina of the sphenoid bone and the medial wall of the parapharyngeal space. Posteriorly, it was limited by the prevertebral fascia and, more superficially, by the carotid sheath. The pterygoid muscles covered it laterally. Superiorly, it involved the posterior part of the body, the great wing and the base of the pterygoid process of the sphenoid bone. More posteriorly, it involved the petrous portion of the temporal bone and the anterolateral aspect of the occipital bone. The inferior wall of the abscess was on a level with the tip of the styloid process.

The left pterygoid muscles and the left masseter were friable, edematous and diffusely infiltrated with pus. The proximal portion of the mandibular branch of the trigeminal nerve from the ganglion to the abscess was swollen, edematous and pervaded with pus. After it entered the abscess, it became frayed out and could not be traced. The trigeminal ganglion was likewise swollen, friable and, in parts, necrotic. Its other two afferent branches presented changes, similar but of a lesser degree, to those noted in the proximal portion of the mandibular division.

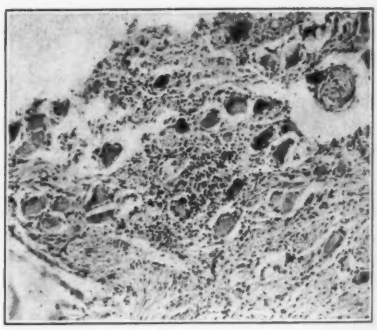

Fig. 2.—Section of gasserian ganglion. (×100.) In the upper middle portion, ganglion cells are seen. These exhibit the characteristic histologic structure of degeneration and necrosis. There is edema and a diffuse infiltration of polymorphonuclear leukocytes and lymphocytes.

There was a yellow-gray subdural plaque of fibrinopurulent exudate localized in the anterior portion of the middle fossa extending to the left for a distance of about 4 to 5 cm. from the margin of the anterior clinoid process.

The circular and both cavernous sinuses contained gray-pink pyoid thrombi. Thrombi of similar character were found in the left and right ophthalmic veins. The left carotid artery from the level of its juxtaposition to the cavernous sinus for a distance of 4 cm. into

the neck contained a deeper red attached thrombus which was of firmer consistency.

The paranasal sinuses and other head and neck structures including the angular veins and pterygoid venous plexus of veins were not remarkable.

Microscopic examination confirmed the gross necropsy findings.

COMMENT

A careful consideration of the clinical and postmortem findings led us to believe that extensive infection in this case was associated with the extraction of a tooth. It is probable that the patient was harboring an apical abscess, for the diseased tooth was loose enough to permit him to extract it. It is possible, however, that infection was introduced at the time of the extraction. Since the tooth was extracted before the patient came to the hospital, we have no definite knowledge of the conditions present at the time of its removal, but the clinical history would suggest that he had an acute alveolar abscess with cellulitis for at least three or four days before extraction. It is surprising that the soft tissues contiguous to the socket of the extracted tooth did not contain evidence of active inflammation and suppuration.

Fig. 3.—Dissection of left side of face showing abscess in sphenomaxillary fossa. Its relation to the posterior wall of the pharynx is to be noted, also swelling of the eyelids due to venous obstruction.

After extraction, the swelling over the canine fossa became more pronounced, indicating an exacerbation of the preexisting suppuration. At the time of admission to the hospital, a fairly advanced suppurative condition was indicated by the acute illness and elevation of the temperature and the pulse. Suppuration in the canine fossa was moderately extensive and yet pain in this region was not mentioned in the clinical history. The area of the abscesses was tender, but not fluctuant to palpation. The clinical pattern was further obscured by trismus. Obviously, the latter was due to inflammation and suppuration within the fibers of the pterygoid and masseter muscles and involvement of the mandibular branch of the trigeminal nerve by the abscess. The forward bulging of the posterior wall of the pharynx which was so evident at necropsy was hidden because of the trismus. If it had been discovered, drainage of the parapharyngeal abscess by means of a stab incision would have made the patient more comfortable. On the sixth day in the hospital, the white blood cell pattern indicated severe sepsis, more severe than is ordinarily encountered in a patient with an acute alveolar abscess.

In regard to the method of extension of the infection, it is reasonable to assume that, at the time of hospital admission, infection had already extended from its initial site and was making its way posteriorly in the soft tissues. Extensive suppuration was found in the superficial muscles of expression and in the buccinator and masseter muscles of the left side. It appears that this involvement was by direct extension since no venous thrombo-

sis was found. There was an attempt at localization in the region of the canine fossa, for there an abscess with a well-formed inflammatory wall was encountered. This abscess was continuous with a series of pus loculations which undermined and permeated the soft tissues posteriorly to the anterior border of the ascending ramus of the mandible.

From this situation, infection and suppuration was distributed in two directions. The first, and least important, was over the periosteum into the masseter muscle as far as its posterior border. The second, and that with which this communication is chiefly concerned, was into the infratemporal fossa. To reach the latter, infection obviously must have penetrated the deep fascia in the plane where it comes forward to be attached along the internal surface of the ramus of the mandible. Here, infection was well localized for some time, as judged by the size of the abscess and its thick walls. Subsequently, the infection became more or less diffuse in this area. The mandibular branch of the fifth nerve in the medial wall of the abscess became involved by direct contiguity. Little trace of this nerve could be found, but its upper, more proximal portion could be traced for a short distance from the trigeminal ganglion. There was a diffuse necrotizing ganglionitis and suppuration along the sheath of the proximal portion of the ophthalmic and maxillary divisions of the trigeminal nerve. These findings strongly suggest that infection proceeded from the sphenomaxillary abscess along the mandibular branch of the trigeminal nerve to involve the ganglion and its other branches.

Lack of mental clarity of the patient probably accounts for the failure to recognize sensory changes in the distribution of the branches of the trigeminal nerve, for, with the degree of trigeminal ganglionitis found at necropsy, it is reasonable to assume that such changes must have been present. Labial herpes not rarely accompanies febrile conditions as so-called "fever blisters." In this case, the sharp confinement of herpes to the left half of the upper and lower lips is interpreted as a direct manifestation of the ganglionitis.

With the advancement of ganglionitis and periganglionitis, the contiguous dura became infected. There was some attempt at extradural localization of infection. The method of involvement of the left cavernous sinus, the circular sinus, right cavernous sinus and ophthalmic veins from this situation is obvious.

The left carotid artery contained a well-formed antemortem thrombus extending from the level of the posterior clinoid process downward for a distance of about 5 cm. Microscopically, there were focal clusters of polymorphonuclear leukocytes, hemorrhagic congestion and some loss of staining of fixed tissues in the adventitia. From the microscopic findings, we believe that periarteritis, and, later, arteritis with thrombosis, developed in the internal carotid artery from direct extension of the abscess or from the affected sinus. In a similar manner, we account for the focal inflammations (microscopic) of the other nerve sheaths.

SUMMARY

Canine fossa and infratemporal fossa abscesses were complications of tooth extraction. The infratemporal fossa abscess involved the mandibular division of the trigeminal nerve. Ascending infection in its sheath was responsible for a trigeminal ganglionitis, extradural abscess, thrombosis of the internal carotid artery and cavernous sinus thrombosis. Cavernous sinus thrombosis and ophthalmic vein thrombosis of the opposite side followed thrombosis of the circular sinuses. There was unusual opportunity for postmortem dissection and detection of these very unusual complications of tooth extraction.

ARABIAN DESCRIPTION OF DENTAL CARIES IN THE TENTH CENTURY

By Elias S. Khalifah, D.D.S., Beirut, Syria

ARABIC medical manuscripts dating as far back as the ninth century and earlier are scattered all over the world. There is scarcely a library that does not contain a number of them. The subjects treated are many and varied, and dentistry is not the least of them. Dentistry was not known as a specialty in those early days, but was considered a branch of medicine. There was hardly a qualified physician who was not able to treat an aching tooth or a diseased gum—in a primitive manner, one might say, but undoubtedly in an honest attempt to relieve suffering, an attempt which should receive consideration. Although it may still be argued by some that their methods were ancient, it may be pointed out that those methods were the best that the world knew at that time. It was not until two centuries ago that we came to know of any better ways.

In a recent paper,[1] it was pointed out that dentistry was practised by qualified men as well as by barbers and quacks. To uphold that statement, I shall relate the following historical fact.[2] When a case of malpractice was brought to the notice of the Caliph of Baghdad in 850 A.D., he ordered his physician to conduct an examination of all practising physicians in Baghdad. Every one who failed to pass the examination was denied the privilege of practising medicine. More than 860 licenses were issued at that time. This is the first record of state-board examinations in the history of medicine.

(Read before the Section on Operative and Preventive Dentistry at the Seventy-Third Annual Midwinter Clinic of the Chicago Dental Society, February 17, 1937.)

'Ali ibn Rabban At-Tabari

'Ali ibn Rabban At-Tabari was among the first to discuss dentistry, which he did in one of his books. He was a Persian, a son of a physician, and lived in the ninth century. 'Ali was a Christian, and not a Jew* as many historians have led us to believe, but he professed Islam after entering the service of the caliph. In 850 A.D., he completed his famous book on medicine and natural philosophy entitled "Firdaus-ul-Hikmat" ("Paradise of Wisdom"), which is considered the oldest book on Arabian medicine.[3] At-Tabari was a great physician and author in his day, and the fact that he was Ar-Razi's teacher does him a great honor and attaches great importance to his works.

There is a good manuscript of Firdaus-ul-Hikmat in the British Museum,† but the book has appeared in printed form in Arabic recently.[4] It is divided into parts which are subdivided into discourses, and these are in turn subdivided into chapters. In all, it has seven parts, thirty discourses, and 360 chapters. There is one full chapter of five pages on the diseases of the mouth and teeth and on halitosis.

Of the organs that produce sound phonation and correct articulation are the lips, central incisors and the nose. If the lips are

*Many historians basing their assumption that "rabban" meant "rabbi" thought that At-Tabari was a Jew. The Christian priests of early days used "rabban" as their title. At-Tabari, in his book "Religion and the World" edited by A. Mingana (Egypt, 1923) says: "And still as a Christian I say, and an uncle of mine says. . . ." (p. 44).

†The study is based on photostats obtained through the courtesy of the British Museum.

cleft or the nose is obstructed with polyp, or if the central incisors fall out, speech is interfered with.

Halitosis is due either to fermentation and putrefaction in the stomach, diseased gum or decomposed food particles remaining between the teeth. If the stomach is the cause it should be cleansed with purgatives; otherwise, use gargles containing pyrethrum and myrobalum. If halitosis is due to loose and corrupted gum, the tanning astringents, or gargling with pyrethrum, marjoram, vinegar and mustard are helpful. If it is due to putrefaction of vegetative growths in the nose, treat by the removal of these growths and the application of healing ointments. When due to putrefied secretions draining from the head to the nose, it is treated by cauterizing the vertex of the head to prevent the flow of that secretion. . . .

If it is due to diseased gum, it is improved by rinsing with vinegar decoction of tamarisk fruit and by the use of a siwak.* If due to phlegm in the stomach, use emetics after meals, then purgatives and stomachic pills. Feed on salted fish which cleans the stomach by virtue of its saltiness, and use a syrup containing chebula myrobalum, mastic, cumin, cloves and cardamon. Let him retain in his mouth the pills prescribed at the end of this chapter, and avoid all fermentable foodstuffs.

If it is due to corruption of the teeth manifested by yellowness, caries and cavitation, extract the bad tooth, file the decayed one and round its edges and cauterize the gum at the neck.

He goes on to prescribe innumerable remedies for toothache, loose and bleeding gum and halitosis. He mentions several tooth-powders and gives a formula for a toothpaste.

Superstition had its hold on him, and had it not been effective in his practice, he would not have mentioned it in his writings. Sometimes for toothache he advises hanging around the patient's neck a hyena's right tooth. In another passage, he says: " If a dead man's tooth is placed on an aching tooth, it is extracted if God so permits."

*A piece of a twig used as a toothbrush. When rubbed against the teeth, its bristles stick out like those of a toothbrush.

ABU BAKR MUHAMMAD IBN ZAKARIYYA AR-RAZI

At-Tabari had as a student a young man who in later years outshone his master and became the ablest clinician that medicine had for several hundred years. He is the Abu Bakr Muhammad ibn Zakariyya Ar-Razi, or Rhazes, of Latin writers. Before he died, in the first quarter of the tenth century, he had written 213 books on medicine, astronomy, mathematics, religion, philosophy and many other subjects. In "Al-Fakhir," he gives a comprehensive and concise description of the teeth and their ailments. My study of this chapter is based on a manuscript that I came across in Beirut.* There are many interesting points about this manuscript. It has a table of contents, which one does not often see in manuscripts. All titles and important statements are overlined with red ink. Nowadays, we underline, and many of us think that this is an innovation belonging to our days. This manuscript shows that even then writers practised it. The section that deals with dentistry, if translated into English, would take about twenty-five double spaced typewritten pages. It is divided into chapters under the following headings:

Teeth
Teeth on Edge
Decay of Teeth
Looseness of the Gum
Suppuration of the Gum
Ulcerative and Bleeding Gum
Halitosis

I quote:

Toothache is either with or without swelling of the gum. When it is with swelling, it is due to an inflammation. *The symptoms* are redness, swelling and relief on cold water. *The treatment* is phlebotomy of the cephalic and temporal veins, cupping, retaining cold water with vinegar in the mouth one day and camphor with rosewater another day. If the pain persists after two or three days, the patient should retain in his mouth oil of roses in

*Property of Sami I. Haddad, M.D., Beirut, Syria; obtained by purchase in Persia.

every 66 drams of which 2 drams of mastic have been dissolved.

If the toothache is without swelling of the gum, it is due to cold or thick humours. The treatment is to apply at the neck of the tooth the theriac of four, or pepper kneaded with tar; or let the patient retain in his mouth any of the following. . . .

It is of rare occurrence that toothache is due to heat, but when that is the case, it is relieved by cold remedies used for the swelling of the gum. . . .

Physiologic and pathologic hyperemias were not known then as such. It seems that these two conditions were recognized by Ar-Razi as abnormal and were described. The question whether teeth are living organs has also been discussed. In speaking of the latter, Ar-Razi quotes another writer*:

The ancients have agreed that bone is devoid of feeling, and since the teeth are made of bone, they are devoid of feeling too. The wise Galen said that they feel and tremble just as the lip does. They also may become numb, which is a very convincing proof that they have feeling. . . .[5]

In this chapter, we have the first attempt to classify the teeth according to function and to give them names according to the work they perform. Ar-Razi does not claim priority in mentioning that, but attributes it to another writer called Serapion.†

The total number of the teeth is thirty-two, sixteen in the upper jaw and sixteen in the lower. Of the sixteen, four are in the anterior part of the mouth. They are broad, have sharp cutting edges and possess one root each. They are known as incisors and are used for cutting soft food. The two teeth on each side of these incisors have sharp cutting edges and one broad root each. They are called canines, dog's canines or dog's teeth. Their use is to cut hard food, and for this reason they were called such, since the dog's teeth are all canines and the greater part of his food is bones. The five big teeth on each side of the mouth are broad and rough and are called molar teeth or grinders. The upper molars have three roots and the lower ones two. The upper teeth have more roots because they are suspended, whereas the lowers are strong and well placed. The last two teeth have four roots in certain persons, and their use is to crush and grind the food. For this reason, they were also called grinders. If the ligament that surrounds the teeth is swollen, it is not possible to treat it without the extraction of the tooth. . . .

The teeth grow and increase in size, and conversely they become bare and diminish in size owing to the grinding of food.

There happens to the teeth sometimes two diseases of contrasting natures—due either to food deficiency or to overnourishment. Food deficiency causes the teeth to dry up and to become weak and soft. Overnourishment causes a disease similar to the swelling of soft tissues due to the same condition. *The remedy that the ancients* used is the treatment for this disease. It is the riddance of this excess by solvents once and by dieting another time.

The thinness and weakness caused by food deficiency has no remedy, and may cause looseness and mobility of the roots of teeth, especially if these are poorly and loosely placed. This condition does not happen to weak teeth only, but may happen when the gum surrounding the teeth has retracted. It is an indispensable condition in old people, and may come early or late according to their temperaments. It may be a difficult ailment in some and simple in others.

The disease that resembles swelling happens mostly to children. You should strengthen the gum with astringents until it becomes healthy. The teeth then become firm.

Acid secretions may cause the teeth to crumble, producing decay and cavitation. You should correct the morbid humour that comes to the teeth. If it is of little quantity, it can be dissolved with the simple remedies used for the painful area, and which are composed of the drying drugs that I shall describe later on.

If the humour is of a big quantity, we should concern ourselves with the purification of the head, for it disappears when the head and body are purified. But as to the teeth that break from excessive softness, we should

*Thabit ibn Qurra, physician, mathematician and astronomer who lived in the ninth century and flourished in Baghdad.

†Yahya ibn Sarafyun, a Christian physician who flourished in Damascus in the second half of the ninth century.

attempt to harden and strengthen them with astringent medicines.

Tartar was recognized as early as this time. Two kinds, green and black, are described. The cause was thought to be the same as that of decay and consequently the same treatment was prescribed.

It is interesting to note that the present condition known today as dry-socket was known and prescribed for. No such name was given to it, but the condition described reminds one of it at once. Ar-Razi says:

If there is infection in the sockets of teeth after extraction, apply this remedy repeatedly: Iris roots and pyrethrum one dram of each, rock alum, pomegranate flowers, gall nuts and sumach, 2 drams of each. Total number of medicines is six.

Teeth on edge received considerable attention by this author. The cause, he says, is a double-fold one, either external or internal. Externally, it is caused by eating something sour or astringent, the proof being that it happens suddenly and disappears quickly. Internally, it is caused by the "sour phlegm" from the stomach. For the treatment of the first, he prescribes the chewing of purslane, gum, wax and walnuts. If this does not afford relief, the tooth or teeth should be covered either with roasted walnuts or with the yolk of a hard-boiled egg. The treatment of the second condition is to cleanse the stomach of its acidity.

The cause of dental caries has puzzled the minds of men for many centuries. It is a well-known fact that the many theories advanced as to the cause of this disease are comparatively new. It was not until toward the end of the last century that Miller and his contemporaries brought forth the chemicoparasitic theory. Men had attempted long before this time to find the cause. The fact that they have failed does not lessen their efforts along this line. The literature is full of such attempts. G. V. Black, in his book entitled "Operative Dentistry," more correctly described as "The Dental Bible," quotes an anonymous German author who wrote in 1530:

Caries is a disease and evil of the teeth in which they become full of holes and hollow, which most often affects the back teeth; especially so when they are not cleansed of clinging particles of food which decompose, producing an acid moisture (literally, a sharp moisture) which eats them away and destroys them so that finally with much pain they rot away little by little.[6]

Six centuries earlier, Ar-Razi gave a somewhat similar statement regarding the cause of dental caries. He does not claim priority in this theory, but attributes it to another Arab author whom he quotes very often.[5] Under the title "Decay of Teeth," he writes:

Thabit says that the cause of dental decay and crumbling of teeth is an acid moisture [the Arabic adjective of "acid" means "sharp" also; acids and alkalis were known to the Arabs then, and undoubtedly the author meant acid] that comes to the teeth. . . . If the tooth has been eaten away in part, fill it. This will prevent the moisture from getting to the tooth, destroys it and relieves the pain. . . . If the decay is insignificant, file away the decayed part until the tooth is even, then cauterize several times with heat and with oil and marjoram water. The cause of the black stain on the tooth is the same as that of decay, and in the majority of cases, the tooth gets stained black first then decays. The treatment is the same. If the stain is cauterized as we have mentioned, the decay is prevented.

Immunization, as is clearly seen, was reasonably and thoughtfully recommended.

The anonymous German author mentioned by Black gives a certain Arab author Mesuë, as an authority. This Mesuë lived in the thirteenth century and wrote about filling teeth with gold foil. In commenting on this, E. C. Kirk wrote, in 1909:

Mesuë was Surgeon to the Caliph Haroun al Raschid, who flourished 786-809. If the reference to Mesuë is correct, it would therefore, indicate that the filling of teeth with gold was known to the Arabs as early as the latter part of the eighth century. Examina-

tion of the writings of Mesuë has thus far failed to bring to light any record therein of the treatment of caries by gold filling. . . .[7]

Kirk is totally wrong in his statement on the subject. He confused the Mesuë whom the German author quotes and the first of the other two Mesuës, who lived in preceding centuries. Historically speaking, the three Mesuës are: 1. Ibn Masawaih, Mesuë the Elder, or Mesuë Major, who died in 857. He also did extensive work in dissection on apes.[2] His "Disorder of the Eye" is the earliest systematic treatise on ophthalmology now existing in Arabic.[8] 2. Masawaih al-Mardini, or Mesuë the younger, who died in 1015. 3. Mesuë the Third, or Pseudo-Mesuë, who lived in the first half of the thirteenth century. Evidently, Kirk mistook Mesuë the Third for Mesuë the Elder, and therefore his theory of gold foil does not apply to the ninth century, but to the thirteenth. Mesuë the Third derived his material from preceding Arabic sources which spoke of gold foil. More seach into the past is necessary to support that idea. Let us hope that in the near future more truth will come to the surface.

To go back to the manuscript: Filling of hollowed teeth is highly recommended. Judging from the innumerable methods Ar-Razi speaks of, one may conclude that the filling method was well thought of and that the materials used did not prove quite satisfactory.

It is the general opinion of many that the filling materials used in ancient times were made of waxes and different pastes the life of which was rather short. Metals are said never to have been used in the filling of teeth up to this time. A statement in the manuscript proves the contrary. We have no proofs yet that metals have been used at this time, but there is convincing proof that a certain metal has been recommended. Ar-Razi recommends "tancar" (accent on the last syllable) as a filling material. "Tancar" is an Arabic word meaning the material that the tinman or plumber works with, or a metallic salt that exists with gold and copper on the surface.

A PLEA FOR A NEW HISTORY OF DENTISTRY

Dentistry has an ancient history that it can well be proud of. Guerini gave us in 1909 a masterpiece in his book entitled "A History of Dentistry," the best history that the profession has had so far.

Since the publication of Guerini's book, so many new facts have been revealed to us that the profession needs a revision of that book or a new one that will rise to the present level of American dental literature.

America has led the rest of the world in dentistry, dental literature and many other lines. It is only fitting that it should also lead in the writing of a new dental history. It is hoped that the American Dental Association will take this matter to heart, as it wisely did in 1909. Dental history is not a field of dead research. It is true that it cannot make the modern dentist more scientific in making restorations, but it certainly can better establish tradition and add prestige to the profession.

CONCLUSIONS

1. The first historical record of medical state board examination dates back to the year 850 A.D., in Baghdad. Dentistry was practised by qualified men, and not by quacks and barbers only.

2. Dentistry was discussed in Arabic books as early as 850 A.D.

3. The siwak, Nature's toothbrush, was used by the Arabs many centuries before the modern toothbrush was introduced.

4. Physiologic and pathologic hyperemias, dry-socket, classification of teeth, diet and teeth and the cause of dental caries were discussed in a tenth century Arabic manuscript.

5. Metals have been recommended for the filling of teeth as early as the tenth century.

6. The dental profession is in great

need of a new dental history. America has led the world in dentistry and in dental literature; and it is only fitting that it should also lead in the publication of a new "History of Dentistry."

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CONGENITAL ABSENCE OF TWENTY-NINE PERMANENT TEETH

REPORT OF A CASE

By Chastain G. Porter, D.D.S., F.A.C.D., and Ralph W. Edwards, B.S., D.D.S., F.A.C.D., Kansas City, Mo.

History.—K. C., a girl, aged thirteen, was one of a family of eight children, ages five, seven, ten, eleven, thirteen, fifteen, eighteen and twenty. Both father and mother are living. The mother lost her teeth at thirty years of age; the father, now forty-six, has most of his teeth and in fair condition. No abnormalities in dentition prevailed in either parent. Data beyond the parents are not available. The dentitions of the other children, except the fifteen-year old son, are normal, that of the eighteen-year-old daughter being especially fine. In the case of the fifteen year old child, sixteen permanent teeth are congenitally missing. The following teeth are present:

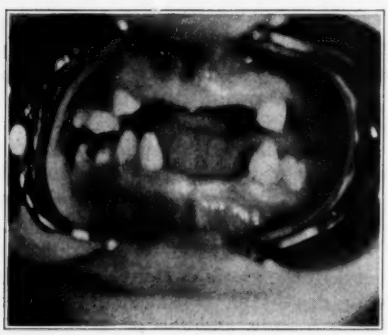

Fig. 1.—Appearance of mouth before removal of teeth.

7 6 3 III 1	1 III 3 6 7
7 4 3 2	1 2 3 4 7

Physical Examination.—The patient was of small stature, height, 55.75 inches, weight 66.25 pounds. The Wassermann and Kahn reactions were negative. There had been no severe or prolonged illnesses, except the common exanthems of childhood. The patient was average or above in intelligence, as evidenced by her school record. Examination

(From the departments of Surgery and Prosthetic Dentistry, Kansas City-Western Dental College.)

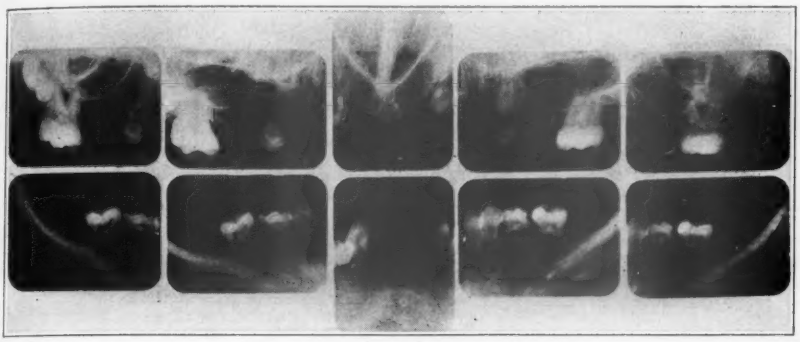

Fig. 2.—Roentgenographic survey.

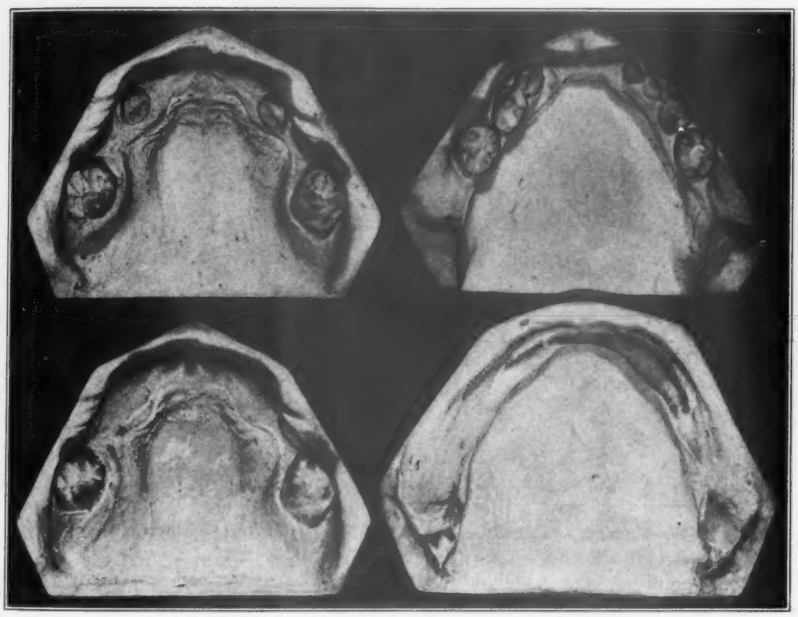

Fig. 3.—Above: Study casts. Below: Casts on which dentures were constructed.

and tests for endocrine disturbances were not made.

Oral Examination.—Visual and roentgenographic examination revealed the presence of three permanent and nine deciduous teeth (Figs. 1-3) according to the formula:

$$\frac{6\ \text{III}\ |\ \text{III}\ 6\ 7}{\text{V IV III II}\ |\ \text{I II IV V}}$$

Normal resorption had taken place on the remaining deciduous teeth. The deciduous dentition had been normal as far as could be determined. The upper left second molar was unerupted.

Treatment.—As the deciduous teeth were quite mobile, they were removed. The upper first molars and upper left second molar were retained.

Fig. 4.—Dentures.

Fig. 5.—Profile view with dentures.

Fig. 6.—Anterior view.

Prosthesis consisted of a maxillary partial and a mandibular complete denture, the vertical jaw relation being opened 10 mm. (Figs. 4-7). No unusual difficulties were encountered, as the patient proved to be quite cooperative. Muscular exercises are being used to develop the lips.

1108 East Tenth Street.

DIET OF A PATIENT WITH A FRACTURED JAW

By H. H. Weisengreen, D.D.S., Fresno, Calif.

DIETS are, of necessity, regulated by the attending physician or surgeon in all critical cases, but when the patient either remains ambulatory or will become so in a few days, the fact is frequently overlooked that proper nutrition may be vitally important. In this category, one finds the case of the uninvolved jaw fracture. If a form of fixation of the jaws has been used, the patient must be restricted to a liquid diet for a period of weeks. This abrupt change in the nature of the diet is almost certain to produce a state of nutritive imbalance which may, on the one hand, generate somatic dysfunction and, on the other, impede cell nutrition. When we consider the influence of metabolism on the reparative bone process, it becomes evident that proper nourishment must be emphasized. Therefore, in order to expedite the healing of the fractured bone, the surgeon finds it incumbent on him to assume the supervision of his patient's dietary. Ordinarily, this will mean ascertaining that properly balanced food elements are being supplied in accordance with individual requirements. However, if the patient suffers from any one of the numerous systemic disorders which require a specialized diet, the task of making appropriate modifications is slightly more arduous.

Advice must be given not only as to the actual menu, but also regarding the simplest and least fatiguing means of taking food. Since imperfect or incomplete dentures are common and some degree of malocclusion is practically universal, particularly after a repaired oral injury, use of the feeding tube or sipper should present no difficulties. While a nasal tube may be employed if the measure is indicated, surgeons generally are agreed that a sound tooth should never be removed for feeding purposes. When the patient is to be fed by mouth, but is not yet able to superintend the process, care must be taken to avoid strangulation. A little later, he will manage his own feeding very satisfactorily and will acquire a surprising aptitude for sipping liquids or semifluids through his teeth.

In connection with the subject of feeding, two relevant points may be mentioned. The act of taking nourishment in an unusual manner often proves immoderately discouraging to the patient. Therefore, to assure the ingestion on his part of necessary quantities of food sometimes requires much persuasion and patience. Another point is the consistency of the foods, which must at all times be smooth. I have found it advisable to instruct that all semifluids be put through a fine-meshed sieve, because of the difficulty of freeing the patient's mouth from food particles. Also, all foods given through a tube should be diluted sufficiently to avoid clogging.

Regarding the subject of nutrition: Even if there were not the wealth of material which already exists, only a particular phase would be within the scope of a single paper. Thus, in considering a dietary for fractured jaw cases, interest centers in those features which are distinguishing rather than in the generally

(From the Division of Orthopedic and Traumatic Surgery, the General Hospital of Fresno County.)

familiar question of foods and their nutritive properties. At the outset, we assume that, except in isolated cases, the patient enjoyed an ordinary degree of health and lived a normal life prior to the occurrence of the fracture. That being the case, it is highly desirable, from a standpoint of nutrition, to have him retain his previous state of physical fitness. At the same time, we wish to provide nutrients that will promote bone healing.

In general, the diet must be high in caloric count and high in vitamin content; which presents somewhat of a problem, since food elements from which these properties are obtainable are necessarily limited. Of equal importance is the need of maintaining appetite appeal. One great disadvantage of any liquid diet is the monotony, a factor which, of course, irks the patient progressively as healing proceeds. Hence, when the stimulation of cellular activity is most essential, a determined effort must be made to provide a palatable variation in the diet.

The degree of physical activity and the individual requirements call for modifications of the caloric intake. Our general rule is a daily count of approximately 2,000. As a preliminary step in charting the actual menu, we made a rough grouping of the following seven subdivisions, which showed the types of food available for our use, even though specific items were not necessarily confined to one group: 1. Beverages. 2. Cereals or gruels. 3. Dairy products. 4. Desserts. 5. Fruit pulps and juices. 6. Soups and broths. 7. Vegetables.

1. In addition to the usual beverages, *i.e.*, tea, coffee, cocoa and milk, there are a multiplicity of commercial products on the market whose reliability has been tested. Among the various malted, cultured, chocolated milks, etc., are particular flavors which appeal to individual tastes.

2. The cereals used should be either the finely processed infant and invalid food preparations or freshly prepared, thoroughly cooked whole grains carefully strained. These offer a valuable means for regulating calories by the combined use of milk, milk and cream or all cream. Sugar, lactose or, perhaps, butter may be added also.

3. The important place held by dairy products is well-known to any one familiar with this type of dietary planning. So essential, in fact, is the combination of milk and cream that at least half of the desired nutrient value of the diet must be supplied by this food.

Eggs rightly assume an important rôle, but because they are "easy" to serve, they are sometimes used excessively. Two eggs daily are considered an adequate adult allowance. While the eggnog is admirably suited to this type of feeding, eggs may be used also to form the basis of several appropriate desserts. As a change, an egg coddled for one minute less than the usual time may be taken through a tube.

4. Desserts have three useful qualities: they supply needed carbohydrates, provide an excellent means of serving milk and eggs and appeal to the appetite. The dessert list is not really so limited as it seems, the important consideration being that in consistency it must be thinner or softer than ordinary use requires.

5. Fruit pulps and juices add an invaluable group to the list. Also, fruits are appealing to the average person's taste. As to their constituents, while the sugars and starches are valuable, their vitaminic factor makes them indispensable. The importance of the vitamins, especially vitamin C, to cell nutrition has been recognized for some time. More recent investigations have convinced scientists that vitamin C plays an active part in bone healing; a fact which places definite emphasis on the need for citrus fruits and tomato juice in these diets. Bearing this in mind, we advise having orange juice available at all times. Incidentally, since vitamin C is not stored in the body cells to any extent, the need for daily ingestion

of foods containing this factor must be stressed.

6. While the usefulness of the meat broth is in its appeal to the appetite rather than in its nutritive worth, its food value may be enhanced by the addition of a cereal and a combination of puréed vegetables. The creamed soup is unequaled from the standpoint of practically every necessary and desirable food element. Then too, the variety is limited only by the number of vegetables which may be puréed.

7. The nutritive factors in vegetables which make them so important a part of the dietary require no comment. In passing, I merely mention their valuable mineral content, referring especially to calcium and phosphorus. These elements are an organic necessity in relation to cell structure and bone formation. Iron, too, is definitely significant in the vital organic processes, and although it may be supplied to the body medicinally, it is more completely assimilated when ingested as a food constituent.

Table 1.—Constituents of Liquid Diet

	Calories
Cereal, two servings	125
Cream, 40 per cent	480
Eggs, two	150
Fruits, pulp and juice (tomato juice included)	500
Milk, one quart	670
Sugar or lactose	150
Vegetables puréed, two servings	50

It was necessary to know not only what types of food were available, but also the caloric value of the actual elements which comprised them. Therefore, these constituents were listed, and opposite each was placed the approximate number of calories that would maintain a satisfactory nutritive balance in a day's ration. Also, Table 1 could be modified as required in special instances.

The requisite distribution of calories thus being ascertained, a daily menu may be planned without difficulty. The menus in Table 2 will serve as illustrations and will show likewise the arrangement for feedings at two-hour intervals, which seemed best suited to the needs of the patient.

Before concluding, it may be well to mention the period immediately following the removal of the fracture appliances. At this time, patients are inclined to go to the extremes of using the jaws too vigorously or not at all. While mastication will aid greatly in restoring normal function to the traumatized area, the newly consolidated bone should be used cautiously for at least one month. During this interval, the patient should be limited to a routine soft diet. After that, he may, with his surgeon's consent, begin to add more substantial items to his menu.

Table 2.—Daily Menus

Hour	Menu 1	Calories
6 a.m.	Orange and grapefruit juice	75
	Farina, milk and cream, sugar	240
8 a.m.	Pineapple juice	100
	Arrowroot gruel, milk and cream, sugar	280
10 a.m.	Fruit whip, cream	160
12 m.	Cream of celery soup	200
	Apple sauce, cream	160
2 p.m.	Tomato juice, cream	135
4 p.m.	Eggnog	200
6 p.m.	Cream of tomato soup	250
	Cup custard	175
8 p.m.	Cocoa	200

Hour	Menu 2	Calories
6 a.m.	Tomato juice	75
	Prepared barley gruel, milk and cream, sugar	240
8 a.m.	Grapefruit juice	75
	Oatmeal gruel, milk and cream, sugar	260
10 a.m.	Banana milk shake	175
12 m.	Beef soup, with two vegetables puréed	100
	Boiled custard	150
2 p.m.	Fruit whip, cream	160
4 p.m.	Pineapple eggnog	220
6 p.m.	Cream of asparagus soup	200
	Junket	200
8 p.m.	Hot malted milk	220

ACRODYNIA

REPORT OF A CASE

By Frank J. Bernard, D.D.S., Chicago, Ill.

Present History.—A white boy, aged thirteen years, complained of boils and abscesses over the body. According to the history, each time a deciduous tooth erupted, gingivitis with a paracoronal abscess developed around the tooth and, at this time, the boils and abscesses over the body became more severe. The condition persisted until the erupting tooth was removed, when the constitutional condition subsided. The same condition was also present when the permanent teeth erupted. On examination of the mouth during the height of these reactions, the mucosa appeared soft and hypertrophic, the gingiva was red and swollen and, around all remaining teeth, lateral and gingival abscesses developed, and the teeth became loose and extremely sore, removal becoming necessary.

Roentgenograms were taken of five teeth. These revealed one upper first molar with almost no supporting alveolar structure around it. The upper cuspid and first bicuspid were surrounded with two-thirds of their normal bony structure and the cuspid root was not completely developed. A lower cuspid tooth and a lower second bicuspid tooth had underdeveloped roots and were supported by about two-thirds the normal alveolus.

The microscopic examination of a smear from the mucous membrane and also from a socket of an extracted tooth revealed pneumococci, staphylococci and gram-negative rapidly growing *Micrococcus catarrhalis,* but no pus cells.

Personal History.—At three and one-half years, the patient was admitted to a hospital for observation because of the gingivitis and paracoronal abscesses around the deciduous teeth. It is to be noted that none of his teeth became pulpless and none were carious. He always appeared to be undernourished and was small for his age. The frequent boils were a serious problem. However, his general health improved each time a tooth was extracted and remained so until the eruption of the next tooth.

At ten years of age, the patient suffered a lung abscess which was associated in time with the eruption of some permanent teeth. This infection of the lung did not improve or respond to treatment until the erupting teeth were removed. Again, at the age of twelve, and with the eruption of more permanent teeth, the patient suffered a siege of rheumatic fever, which persisted until the remaining teeth were extracted.

At the present time, the patient is suffering from a mild psoriatic condition.

Family History.—The patient's father and mother are cousins. The father has been in good health all of his life. The mother had scarlet fever in childhood and rheumatism at the age of sixteen. Two uncles on the maternal side had died, one of tuberculosis and the other of asthma. Four sons and three daughters were born to this family. The eldest son died at the age of six years, of tetanus. The eldest daughter had bronchopneumonia at fifteen months of age. When she was three years old, she had gingivitis and abscesses around the deciduous teeth, all of which were removed before she was six years of age. All teeth were vital and non-carious. When her present teeth erupted, a similar infection developed, and because the teeth became loose and painful, they were extracted. She also had boils over the body, which varied with the amount of infection in the mouth and improved after each extraction of teeth. Psoriasis had, however, developed, and persists, even though the infection of the mouth has not been manifest since the removal of all remaining teeth at the age of thirteen. There is marked susceptibility to head colds.

The third child, a boy, died at the age of two of an infection of the throat during an attack of chickenpox.

(Read before the Chicago Section of the International Association of Dental Research, October 1936.)

The fourth child, a girl, died of tuberculous meningitis at the age of two. The fifth child, a boy, is in good health, and his mouth and teeth are in good condition. The patient is the sixth child. The seventh child, a girl, is well and her mouth and teeth are in good condition. She has had chickenpox, measles and mumps and has undergone a mastoid operation. She now has psoriasis.

There are many pathologic conditions which have been attributed to the blood relationship of parents or more distant ancestors. This case history may, however, be compared with that of a rare condition which is known as acrodynia. Any disease which carries as many different names as acrodynia is one regarding which there is much disagreement among the different investigators and observers. Some of the synonyms are infantile acrodynia, pink disease, vegetative neurosis, trophodermatoneurosis, neurovegetative syndrome resembling pellagra, Swift's disease (erythredema) erythema epidemicum and chiropodalgia. There is a great deal of discussion in the literature with many case histories, few of which display symptoms of a uniform and common character.

HISTORY OF THE DISEASE

An epidemic was reported by the French in 1828 to 1830 and the syndrome presented was rather similar to that of acrodynia. Sweden and England have since experienced epidemics of comparable diseases, the etiology of which was traced to arsenic in beer and wine. It is probable that the condition found in the infant is different from that occurring in the adult. At least, the infantile type has never been traced to arsenic. Australians have observed this condition for about forty years. In America, it has been identified for fifteen years, and Selter of Germany reported a series of cases in 1903. It should be mentioned that in 1917 Byfield, of Iowa City, Iowa, prepared a paper on acrodynia to be presented before the American Medical Association that year, but he was unable to read it because of illness.

ETIOLOGY

Three theories are offered as to the etiology. The first is that an infection of unknown specific character exists in the upper respiratory tract, particularly the nasopharynx. The second contention is that a food deficiency commonly known as avitaminosis exists. The similarity of this condition to pellagra and beriberi, together with the definite improvement noted in some of the patients when a corrective diet is prescribed and the favorable experimental work with liver added to the diet, furnishes this theory with a rather sound basis. The third and last theory is offered with much caution because, as de Mello and Wilson state, "that theory is so mysterious and alluring that unless we have real definite proof that such a state actually exists, the less said the better, as undoubtedly this theory has led us into many pitfalls as we are dealing with a condition about which we know so little." The theory suggests that the disease is a disturbed balance of the vegetative nervous system.

PATHOLOGY

Only a few cases have come to necropsy and, therefore, many facts remain unobserved. Warthin found in each of two cases an edema of the brain, cord and meninges with a dilated central canal of the cord. Others have found no change in these structures. The most satisfactory observations as they relate to the syndrome are to be found in the report of Orton and Bender's findings of Byfield's Case 13. They found definite lesions of long standing at several levels in the lateral horns of the cord. In these areas, there was not only a marked destruction of the cells, but also many of the normal cells were undergoing a process of degeneration by chromatolysis, fragmentation and sclerosis. Weigert-Pal stain revealed a definite contrast between the anterior and lateral horns by the loss of myelin in the lateral horn. The nerve fibers in these lesions were small and shrunken and were undergoing fragmentation. There was a moderate lympho-

cytic infiltration and numerous small hemorrhages. The lesions bore a resemblance to the healing stages of anterior poliomyelitis. The peripheral nerves showed areas of myelin degeneration. The sympathetic nerves were not affected; the muscles revealed simple atrophy, and in the skin there was edema with hyperkeratosis. The endocrine glands were negative except for a hypoplasia of the suprarenal medulla and, in the lymphatic system, there was a hyperplasia of the lymph nodes with degeneration of the germinal centers. The cardiorespiratory system revealed an extensive sinus involvement (hypoplasia of the heart and aorta have been described), and, in the lungs, both tuberculosis and bronchopneumonia are apparently aggravating conditions.

Gastro-intestinal lesions may show areas varying from those of catarrhal enterocolitis to small ulcers. There may also be extensive lymphoid infiltration into the various organs, marked necrosis of the mandible, sclerosis of the cranial bones, cloudy swelling of the heart, liver and kidneys, chronic splenic enlargement and trophic ulcers of the tongue, cheeks, fingers and regions of the knees.

SYMPTOMATOLOGY

The symptoms are by no means common to all cases. Some of the more outstanding findings in the reports of cases are increased irritability, insomnia, perhaps a low grade fever, photophobia, conjunctivitis, lacrimation, profuse sweating and a general miliary rash. The typical pink appearance of the hands and feet usually appears about the second or third week. This rash is characterized by a swollen, cold, beefy, slightly cyanotic erythema, which is most evident on the tips of the fingers and toes and which shades back to the normal tissues in a gradual manner. Trophic ulcers in the mouth and necrosis of the mandible are not uncommon. There may be diarrhea, but most frequently constipation is evident. The hair may fall out and hemorrhage in the eyes may take place. The pulse usually becomes rapid. High blood pressure is considered by some as a positive diagnostic finding.

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Editorial Department

VINDICATION

WE have a confession to make. Frankly, we confess that we are a bit weary of the effort that it sometimes requires to justify dentistry to the public, and even in certain instances to the profession itself. It seems to take so little to cast a reflection on the service that is rendered in the name of dentistry. It is the same with medicine. But both professions can "take it." We neither assume infallibility nor are we essentially thin skinned.

We love a joke even when it is on ourselves, and we hope we can smile under punishment. We are not holier-than-thou in any sense. We are just plain human. And being human we want fair play. It does not help us to be constantly misrepresented by writers and made the butt of every senseless and pointless gibe at our calling.

We make mistakes—of course we do. And sometimes these mistakes are serious, even distressing. We make more mistakes than we should,

but that is only saying once again that we are human. We have never yet claimed divinity in any of our professional service. The moment we did that, we should be as vulnerable and ridiculous as the ones who seek to belittle us.

But here are some things for our detractors to contemplate: If given what in the vernacular is called an even break, we save the natural teeth from destruction. We cannot do this without cooperation on the part of the patient. Even with the character of cooperation that the patient is able and willing and intelligent enough to give, we cannot always save them.

We acknowledge our limitations, but today there are countless thousands of natural teeth doing efficient, safe and satisfactory service to the unlimited benefit of the people which, without our service, would have been sacrificed long ago. Think of that.

If the teeth are intended to serve any useful purpose in the economy of nature, the efforts to preserve them on the part of the members of our profession are eminently justified and essentially praiseworthy. How much the longevity of the race has been increased by the service of the dentist can never be accurately computed, but reasoning from analogy and the most searching evidence, we have added immeasurably to human life and made that life more livable and much happier.

Even with all of our failures, which we frankly acknowledge, even with our pathetic limitations, which we do not seek to evade, we still have a substantial balance on the credit side. And then at the apparent end of it all, when "the last full measure" of our devotion has been given in vain, and the natural teeth are finally lost, this is by no means the actual end. What shall be said of the fervent, even the heroic efforts at rehabilitation? Never in the infinite experience of mankind has there been a more signal or successful attempt to remedy the ravages of disease and destruction than in the case of artificial substitutes for the lost natural teeth. The ingenuity and devotion of the dental profession have been taxed to the utmost, and have been given whole heartedly to the problem of rescuing from disability and infirmity the mouths of many of our citizens.

And the success of this service has been one of the most outstanding of all human achievements. The pathetic wrecks left by the loss of the natural teeth have challenged the dental profession to remedy this appalling disaster to humanity.

In all the annals of professional service, no need has ever been more loyally and valiantly met. Artificial substitutes have been designed and executed that defy detection even on the part of the most discriminating

members of our citizenry, and the afflicted ones of society have thus been enabled to go about in the ordinary affairs of life with perfect assurance and the utmost confidence that their disability will never be detected.

And it is not only in the matter of esthetics that this service is significant: The health value of restoring function where this function has been lost cannot be ignored or even estimated. When, in many instances, artificial teeth have given efficient service for nearly or quite half a century, to the undoubted benefit of the wearer, there is no questioning the beneficence and value of such service.

We may quibble about a trivial failure here or there, and we may lament the grief that sometimes accompanies the wearing of artificial dentures; but, in the mass of humanity who today are destined to wear them, we venture that a chorus of protest would ascend if the privilege of of using them were suddenly taken away. This of itself would attest their value and importance.

In view of all of these facts, why is it that we are so frequently regaled with avid attacks on the slightest failure in the intent or execution of any of our technical procedures? Must we perforce be considered gods and held to account as such in any judgment that is passed on us? Again and again, we have acknowledged our limitations, almost to the point of subserviency; but now the time has come when it may be considered salutary for us to assert our prerogatives and not be willing to subsist so frequently on humble pie.

If we have not justified our existence as a profession and vindicated our claims to recognition, no profession has. Let us hold our heads a bit higher, and not mope around in an implied attitude that we are "only a dentist." Let it not be forgotten that it was a dentist who gave anesthesia to the world. And that is not the only thing that dentistry has done: It has conserved the health and sweetened the lives of myriads of our fellow men, and, what is more, it can do the same thing for myriads yet unborn. Think of the blessings of orthodontia and its outstanding beneficence in relieving the deformities of little children.

The limit of our possibilities has not been reached, and it never will be reached through the agency of subserviency. We must claim our legitimate prerogative and prestige, and then we must religiously live up to the claim. In no other way shall we ever justify our calling and come fully into our destined heritage.

EDUCATING THE PUBLIC DENTALLY

Upon the realization of the impossibility of stopping or preventing the ravages of dental caries by mechanical means alone, the basis upon which dentistry had its origin and upon which it was practised almost entirely up to well within the purview of the present generation, it was apparent that until we knew more about the etiology of dental caries, we could only hope to remedy its immediate expressions and depend upon educating the public to the desirability of seeking dental service sufficiently early to enable us to control it. Response on the part of the public to such a plan was, of course, dependent upon the success of the efforts of the dentist to educate his clientele and through it the public at large.

In this educational effort, the manufacturers of mouth preparations have eagerly volunteered to help us, but the beneficial results from this source have for the most part been doubtful. While dentistry has received considerable publicity from this source and it has probably created a certain amount of respect for dental service, it is a respect impelled by fear of the results of neglect, rather than through an appreciation of the health-promoting value of dental service.

The dentist, then, in his educational efforts, at least the one who recognized his responsibility and obligation in this respect, was faced with the necessity of first correcting the impressions of miseducation, and then laying the foundations for further and proper educational efforts.

The oral hygiene campaign some years ago was practically the first reaction of the profession to the realization of its obligation as a health service and the desirability of lending a hand in promoting the ideal of prevention then and now occupying the attention of the medical profession. Just how well we have succeeded in educating the public, or possibly more correctly the class who were already sufficiently impressed with the value of dental service to be included in the clientele of a dental practitioner, is fairly well indicated by the answers to a questionnaire prepared and sent out by Dr. E. J. Ryan and the summarized interpretation of them reported in Dr. Ryan's paper in the present issue, entitled "What Do Your Patients Know About Dentistry?"

While we believe that Dr. Ryan has properly interpreted the results

of the questionnaire, we have been impressed with the apparent paradoxical nature of the results. In other words, we have been much impressed, not to say surprised, with the accuracy and extent of the knowledge of many of these patients regarding some of the dental conditions under consideration; and on the other hand, we are somewhat astounded at the lack of knowledge on the part of some regarding matters that we thought were well understood by every intelligent dental patient.

We do not for a moment believe that it is the duty of every dentist to undertake to educate his clientele in the technical aspects of dental practice; we do feel, however, that the answers to Dr. Ryan's questionnaire indicate quite clearly that all dentists do not devote the attention they should to educating their patients in ordinary matters relating to mouth health and the dentist's relation thereto.

While the educational endeavors of the large majority of the profession, though in numerous instances inadequate and half-hearted, have been wholesome and helpful, some of these efforts, related particularly to pathological conditions of the mouth, have tended to create in the patient a fatalistic attitude toward the teeth as a whole. As a specific example of the latter, we cite particularly the widespread impression regarding oral focal infection, namely, that in cases of oral focal infection the teeth must eventually and in most cases immediately be lost if we are to avoid jeopardizing the health and welfare of the body as a whole.

The popular belief regarding root-canal filling is another example of the character of education presented to the public being influenced greatly by the success or failure of the operator's individual efforts, and also probably by too positive and unwarranted opinions of the medical practitioner toward dental operations and conditions.

The misconceptions of the public and the medical profession regarding the care of the teeth and mouth of the expectant mother is another example of dereliction of educational duty and obligation on the part of the dental practitioner.

But probably the most far-reaching misconception regarding dentistry is the erroneous belief on the part of the average patient in the finality of the dental restoration.

We are convinced that the failure of many dental restorations has been due to failure of the dentist to instruct the patient in the care and attention he should give to the restoration. The patient should be told what to expect of an artificial substitute, and impressed with his responsibility in the case rather than allowed to believe, as many do, that the life of any dental restoration should be coeval with the life of the patient.

The early code of ethics is probably the best guide as to the obligation of the practitioner to the patient regarding information on dental matters, and in this regard it says:

"It is not to be expected that the patient will possess a very extended or a very great knowledge of professional matters. The dentist should make allowance for this by patiently explaining many things which may seem quite clear to himself, thus endeavoring to educate the public mind so that it will properly appreciate the beneficent efforts of our profession. He should encourage no false hopes by promising success where in the nature of the case there is uncertainty."

Another and much desired result that may come from the educational endeavors of the individual practitioner to his patients is the engendering of more respect for his work in what may be considered the higher class of the public. A highly regrettable lack of respect for dentistry is quite apparent at times among newspaper and magazine writers who still persist in the antiquated predilection for treating dental matters disparagingly.

Men who are avowedly championing the welfare of the community should certainly appreciate the desirability of a healthful gateway to the sources of life and should certainly be the last to discredit and belittle the efforts of a profession that contributes materially to the welfare of all communities.

There are numerous ways and means available to dentistry for the education of the public in the desirability of mouth health service as an important factor in bodily health, but in all likelihood the most effective means is the personal instruction that can be given in the atmosphere of the dental operating room. It is surely immediately following a dental operation that the patient is most receptive to suggestions and admonitions regarding the importance of proper care of the mouth and teeth in their health relations to the body as a whole. This is certainly the psychological opportunity for effective dental instruction, and one that we feel should be more generally improved than is ordinarily the case.

While probably the first duty of the practitioner is the care of the dental needs of the individual patient, we must get beyond the conception that the rendering of dental service is an individual benefaction, and realize that it is a public health measure which benefits the whole community by raising the standards of living and by improving health and happiness, which make for a more contented, orderly and efficient citizenship.

L. P. A.

ASSOCIATION ACTIVITIES

LEGISLATIVE COMMITTEE

DENTAL PRACTICE ACTS: INJUNCTION TO RESTRAIN ENFORCEMENT OF LEGISLATIVE BAN ON ADVERTISING

THE plaintiff, a licensed dentist, owned and operated a chain of dental offices in Iowa. In connection therewith, he advertised extensively in the newspapers. In 1935 the legislature of Iowa forbade all advertising by dentists other than the use of professional cards and window or street signs at the licensees' places of business. The plaintiff thereafter instituted proceedings against the state commissioner of health and others to enjoin the enforcement of the ban on advertising. The trial court dismissed the plaintiff's petition and he appealed to the Supreme Court of Iowa.

The appellant did not apparently question the right of the state, under the police power, reasonably to regulate the practice of dentistry but urged strenuously that the legislation must bear a fair relation to the public health, morals, safety or general welfare of the people, and that so long as there is nothing untruthful in advertising matter the public welfare is not adversely affected. He contended, further, that the legislature, in attempting to regulate the practice of dentistry, had destroyed his right to practice. But, the court said, the restrictions placed on advertising have the sanction of the dental profession as a whole. They are intended to preserve the profession, not to destroy it. Such laws are not enacted for the benefit of any class of individuals but in the interest of the general public. In the sense that they tend to prevent an unseemly rivalry in a race for business and preserve a rational, reasonable and ethical approach to the public and aid the profession in maintaining its service on a high plane of efficiency, such laws may be said to be beneficial to the profession as a whole. But this is not the primary purpose of the law. It is but one of the beneficial and beneficent fruits of the law. By making unlawful all methods of advertising calculated to bait or allure the public, the quack, the charlatan and the exploiter are deprived of any means of plying their art. Likewise the member of the profession who would seek to commercialize it by boosting himself through extensive use of methods of publicity, extolling the superiority of his services, thereby forcing his competitors into a race for business, to the demoralization of the high standards and established ethics of the profession—all of which worketh ill to the public—is successfully thwarted in his purpose. It is true, said the Supreme Court, that the authorities are not uniform in relation to this matter of truthful advertising, and many of the earlier cases may be cited to the effect that legislation of this character can only be directed toward eliminating advertising which is false and fraudulent and intended to deceive the public. More recent cases, however, seem to go deeper into the philosophy and purposes of such legislation.

The experience of mankind, said the court, has shown that human greed and avarice, untrammeled and uncontrolled by law, will not hesitate to prey on the

frailties of overcredulous human beings. Those affected by real or imaginary ills are an easy prey. The unscrupulous as well as some of the more honorable but avaricious members of the profession, in disregard of the ethics of their profession, are many times overcome by the great temptation to become rich at the expense of humanity, with all its afflictions. They have resorted to all the devices of the faker on the street corner and of the skilful artisan of export advertising and radio propaganda, some even going beyond the borders of the United States with their broadcasting stations, where they may exploit their victims without hindrance. Such methods are demoralizing to the profession and detrimental to society. While the object of the statute is to strike at the charlatan and unscrupulous practitioner, no legislation can be upheld which would apply alone to the quack. Such legislation must be general in its application and rest alike on all members of the profession concerned. The best interests of the public demand that members of a profession affecting the public health stand or fall on the merits of their services; not on their skill in advertising.

It was for the legislature to say whether or not it was necessary that all advertising except that designated in the statute be prohibited. That is the real pith of the controversy in this case. There is no claim that in itself there is anything harmful in advertising prices for dental work or displaying signs illustrating bridgework, or running stories in the newspapers. It must, however, be admitted, said the court, that there are some dishonest and disreputable members of the profession who are not willing to abide by what is commonly called the ethics of their profession, and who make use of such methods of advertising. The unsuspecting public and overcredulous members of society, unable to distinguish the true from the false, or the honest from the dishonest, are lured to the offices or lairs of the professional charlatans, who point to their array of expensive office equipment and overstuffed furnishings to convince their unsuspecting patients of their superiority, and use this as an excuse for "fleecing them." In order to reach this evil and attempt to correct it, in the interest of the public welfare, individual rights must give way to the greater rights of the whole people. While under the Iowa statutes the limitations on advertising are rigid, they are not too rigid when the purpose or aim of the law is considered. The law, in the opinion of the court, bears a fair relation to matters of public health and the moral and physical welfare of the people.

The Supreme Court did not agree with the appellees' contention that the plaintiff had no standing in a court of equity. The enforcement of this law, the court said, will undoubtedly constitute a serious restraint on the plaintiff's prior methods of conducting a lawful vocation and will result in a financial injury. If the law is unconstitutional and void, he has a right to restrain its enforcement. He is not required to take the risk of forfeiting his license before he may proceed in equity to challenge the constitutionality of the law. It would be an unjust and arbitrary rule which would require him to proceed first openly to violate the law and thus place himself in a position to have determined the question of the constitutionality of the statute.

While holding that the plaintiff had a right to proceed in equity, the Supreme Court was of the opinion that the decree of the trial court denying the plaintiff's petition for an injunction was correct. The decree was therefore affirmed.—Craven v. Bierring, State Commission of Public Health *et al.* (Iowa). Medicolegal Abstracts, *J.A.M.A.*, 109:819, September 4, 1937.

PRACTICE OF DENTISTRY UNDER ASSUMED NAME UNLAWFUL

THE dental practice act of Michigan forbids the practice of dentistry under any false or assumed name, or under the name of a corporation, company, association, parlor or trade name, or any name other than that under which the license of the practitioner was granted. The state board of dentistry served written notice on a number of dentists informing them that on and after a certain date the prohibitions contained in the dental practice act would be enforced. The plaintiffs in the present action, all licensed dentists, instituted proceedings to enjoin the board from interfering with their practice. The trial court dismissed the plaintiff's bill of complaint and they appealed to the Supreme Court of Michigan.

The bill of complaint disclosed that plaintiff Raymond H. Dix conducted five dental offices in Michigan under the name of "Dr. Dix Dentists." Five other plaintiffs used substantially the same modification of their respective names. Plaintiff Treverton E. Lewis practiced dentistry under the title of "Peerless Dentists." Plaintiff William G. Zieve operated four dental offices under the style of "Dr. Zieve's Modern Dentists." The business of plaintiff J. Bain McGilvray was carried on under the name of "Red Cross Dentists," and that of plaintiff Gordon B. Sullivan under the name of "Dr. G. B. Sullivan's Practical Dentists." The plaintiffs contended that the dental practice act, if it prohibited them from practicing dentistry under the titles they used, was unconstitutional. The legislature, said the Supreme Court, in enacting the dental practice act, undertook to provide conditions essential to regulation, to prevent deception, and to require a definite and accurate announcement to the interested public as to the individual identity of each dentist who is practicing in a dental office.

To accomplish this end, it prohibited the practice of dentistry by any person "under any name other than that under which his license was granted." Such a prohibition does not impose on those practicing dentistry a regulation that is either arbitrary or unreasonable. The provision is reasonably suited to the requirement of proper supervision of the practice of dentistry. It also provides prospective patients with pertinent information. Clearly, the court thought, it is both competent and proper that the legislature should forbid the practice of dentistry under an assumed or fictitious name, such as "Peerless Dentists," "Red Cross Dentists," "Dr. G. B. Sullivan's Practical Dentists," and "Dr. Zieve's Modern Dentists." The court could see no hardship or anything that was arbitrary or unreasonable in requiring a person engaged in the practice of dentistry to include in the name under which he carries on his profession the identical name under which he was licensed to practice.

The legislature further prohibited the use of any word or words as a part of the business name which are either "false" or "assumed." In the opinion of the court, it would be too narrow a construction of legislative intent to hold that the use of a name, otherwise conforming to statutory requirement, was violative of the act because it had affixed thereto some such word as "dentists," "associates," "employees," or the like. The appended word or words, in such a case, would not convey a false impression or mislead the public. It would be contended, the court said, that John Doe, a dentist, might not in his practice use the business title, "John Doe, Dentist." If he employed other dentists in his office, a sign reading "John Doe, Dentists" would tend to accuracy and be informative rather than deceptive. If John Doe desired to convey to the public that other

dentists in his office were his employees and hence under his control as to quality of service, etc., he might well carry on his profession as "John Doe's Dentists." Such a designation speaks the truth. It is not a false or assumed name, nor a "parlor trade name"; it accurately discloses the full name under which John Doe was granted his license.

The court disagreed with the plaintiffs' contention that they had a vested right in their respective business titles, accrued to them from a long established professional business and the expenditure of large sums of money in its development. A dentist enters on the practice of his profession, the court pointed out, knowing it is subject to reasonable regulation by the state. He has no right to use, or by reference to continue to make use of, a type of business title which in its exercise of reasonable regulation the state has forbidden. The Supreme Court disagreed with the board's contention that a court of equity has no jurisdiction to grant the injunctive relief sought by the plaintiffs, that each of the plaintiffs had an adequate remedy at law by urging as a defense his contentions in event of legal proceedings being instituted against him. The situation with which the plaintiffs were confronted, in the opinion of the court, threatened them with irreparable injury and a court of equity had jurisdiction.

With respect to some of the plaintiffs, the court could not determine from the record whether or not the names under which they were carrying on their profession complied with the requirements of the dental practice act. In view of this uncertainty, the court remanded the case to the trial court, with directions to set aside the order dismissing the bill of complaint and to take such further proceedings as might be requisite for final disposition.—Lewis v. Michigan State Board of Dentistry (Mich.), 269 N.W. 194.—Medicolegal Abstracts, *J.A.M.A.*, **108**:2070, June 12, 1937.

A-D-A 1938 DENTAL APPOINTMENT BOOK

PREPARED BY THE BUREAU OF PUBLIC RELATIONS

REALIZING the need for a smart, yet dignified professional appointment book, the Bureau of Public Relations has prepared one for you.

Bound in black immitation leather, gold stamped and loose leafed, this 7½ by 10¼ book lies flat when open and shows a full week's appointments at one glance.

In addition to the appointment pages it contains the following information: 1938 Officers and Board of Trustees; District Map of A.D.A.; Organization Chart; Code of Ethics; List of Certified Dental Materials; List of Books and Package Libraries; List of Dental Health Educational Material; Weights and Measures; Patient Recall Service and the Beneficial Circle Plan.

Order from page A-36 of the present issue of the Journal of the American Dental Association.

BUREAU OF PUBLIC RELATIONS

NATIONAL DENTAL HEALTH POSTER CONTEST

ONE of the major educational projects undertaken by the American Dental Association this year is a nation wide dental health poster contest. Proposed by C. Willard Camalier, President of the American Dental Association, and approved by the Board of Trustees, the project was launched early in October in order to give every school and every school child an opportunity to enter.

The contest is open to all children above the third grade in all public, private and parochial schools. The plan provides for each component or district society to hold its own contest. The winning posters in those contests are to be entered in their state contest next Spring. All posters entered in the separate state contests are eligible for entrance in the National Contest next Fall at the Annual Session of the American Dental Association in St. Louis. It is Dr. Camalier's hope that we shall be able to bedeck St. Louis from stem to stern with dental health posters contributed by children from every corner of the country.

Early in October, the committee mailed copies of the plans to all society presidents and secretaries. Already several societies have their plans well under way. All societies are urged to start immediately. Time flies and posters cannot be planned and prepared overnight.

It is most important that all state and component societies cooperate by sponsoring a poster contest. The more contests, the more posters; the more posters, the more people thinking of preventive dentistry.

Read the plans and rules below and then act. Give the children in your community an opportunity to win a prize and national recognition.

National Dental Health
Poster Committee
J. M. WISAN
J. BEN ROBINSON
VERN D. IRWIN
MARY H. WESTFALL
WILLIAM B. SPOTTS
LON W. MORREY,
Chairman

GENERAL PLAN

The American Dental Association is sponsoring, for 1938, a National Poster Contest. Children above the third grade in all public and parochial schools are eligible to compete.

CONTEST PLAN

Each state society, and through it, each component society is asked to sponsor a poster contest in its community.

The winners of the component society contest will compete in the state wide contest.

All posters displayed at the state contest, whether they are winners or not, will be entered by the state dental society in the National Contest, which will be held in October 1938, at the A.D.A. meeting in St. Louis.

POSTER COMMITTEES

Each state and component (*i.e.*, district, county and city) society will appoint a live, active poster committee to promote the contest in their community.

Suggested Duties of the Component Society Committee.—1. Ask the authorities of all public and parochial schools to cooperate by having their children prepare posters.

2. Appoint an advisory committee composed of art teachers, educators and members of the parent-teacher association to help plan the contest.

3. Secure the cooperation of the local civic clubs, such as the Rotarians, Kiwanians and Lions, and others. Let them offer, through your committee, prizes for the winning posters in each group.

4. Announcements of the contest can be made at teachers' institutes and similar gatherings of educators. Also, it should be announced in the publications of the state department of education and state board of health.

5. The component contest should close early enough that all posters can be displayed and judged in time to allow the winners to enter the state contest.

6. A judging committee of five, on which is an art director, an educator and a dentist, plus two other persons, should judge the posters.

7. The general rules governing the National Contest can be used to govern the component contest plus such other rules as may be necessary to cover local conditions.

8. Any number of posters may be exhibited in the component contest, but not more than fifteen can be entered by the component society in the state contest. These will consist of the first, second and third winners in each of the five groups. (See No. 12 under poster rules.)

9. The first, second and third winners in each group should be given an award which the local committee feels is suitable.

10. In addition, the A.D.A. will present each winner with a certificate of award.

11. All children should be instructed to consult their dentist and teachers and to write to the dental division of the state health department for ideas and suggestions.

Ideas can also be secured from the city health department, county and city nurses and hygienists.

12. If possible, it is advisable to display all posters in one hall or building at the close of the contest. Make an event of this display. Invite the public to be present to review the display and witness the awards given the winners. Make the occasion an important dental health rally. A program consisting of music, one or two short speeches and a dental health movie can be arranged. For publicity purposes, display posters in store windows and at county fairs, teacher's institutes and parent-teacher conventions.

Bring the subject of preventive dentistry home to the parents of these children at this meeting. The press invariably will carry pictures of the winners and their posters, bringing the dental health message to thousands in the community.

13. At the conclusion of the local contest, the poster committee will retain the winning posters and send them to the chairman of the state poster committee.

14. All other posters should be retained by the poster committee and rotated from school to school, to be used for educational purposes.

Duties of the State Society Poster Committee.—1. The state poster committee could very wisely be composed of the chairmen of the component poster committees.

2. The state committee can keep in touch with the component committees and help them promote their local contests.

3. The general rules governing the National Contest can also govern the state contest, plus such other rules as the state committee deems necessary. It is wise to conform as closely as possible to the rules governing the National Contest as this will help in the final judging.

4. As most of the state societies hold their annual meetings in the late Winter and Spring, the state poster committee should see to it that the component committees send in their winning posters for display at the state meeting.

5. Display all posters at the state meeting if possible. If you do not hold your next state meeting in time to enter the National Contest in October, 1938, collect and display the component winning posters at some central point.

6. Make an occasion of the display. Invite the public and make a few speeches and furnish an entertainment. If possible, the judging of the posters may be done a few days previous to the public meeting so that the winners of the state contest can be present and be presented with their awards.

7. A judging committee of five should be appointed on which should be one outstanding artist, an outstanding educator and a dentist, plus two other persons.

8. First, second and third winners in each of the five classes should be selected (See No. 12, General Rules).

9. The state society should present awards to the winner (the nature of the awards to be decided on by the state committee). The A.D.A. will furnish suitable certificates.

10. At the close of the state contest, all posters entered are to be carefully collected and retained by the state poster committee. Next Fall, the committee will enter them in the National Contest at the A.D.A. meeting in St. Louis.

POSTER CONTEST RULES

1. Eligibility: The contest will be open to children of the rural and urban grade and high schools and to students of vocational training schools.

2. Subject: All posters must illustrate one or more phases of preventive dentistry or dental health such as (1) proper diet, (2) exercise of the teeth and jaws, (3) mouth cleanliness and (4) preventive operative dentistry.

3. Size: All posters must be uniform in size; that is, 12 by 18 inches.

4. Material: Stiff cardboard, illustration board, or any self supporting material should be used. Posters that are rolled or folded will not be considered. No frames are allowed.

5. Text: Posters may contain a dental health slogan of not more than nine words.

6. Number of posters each contestant may submit: Each contestant may submit but one poster.

7. Mediums: Posters may be made with oils, water colors, crayon, dry brush, ink or cut outs.

8. Ideas: The ideas embodied in each poster should be as original as possible. Posters containing advertising matter or the name of a dentist will not be considered.

9. Identification: Each poster must bear on the back: the name of the child, his or her address (state, city and school) and school grade, the date and the population of the town. (If a rural school or vocational training school, so state.)

10. Possession: All posters that, by the process of selection, are entered in the National Contest next Fall are to become the property of the American Dental Association.

11. Basis for awards: Originality of design will count 35 points; neatness and general appearance, 15 points; distance that message is visible, 20 points; dental health message, 30 points.

12. Awards: Five first awards, five second awards and five third awards will be given to the winning contestants that enter the National Contest.

Entries will be classified as follows:

(1) Rural school

(2) Fourth, fifth and sixth grade elementary urban schools

(3) Seventh, eighth and ninth grade urban (junior high schools)

(4) Tenth, eleventh and twelfth grade urban (senior high schools)

(5) Vocational schools

13. Nature of awards: Winners in component and state contests will receive certification from the A.D.A. and such local awards as component and state dental societies agree on.

Winners in the National Contest will be awarded beautiful loving cups by the A.D.A.

14. Judges: The judges for the National Contest will consist of nationally known artists, teachers and dental health educators.

DENTAL EDUCATION IN SALT LAKE CITY, UTAH

By D. L. Folsom, D.D.S., Salt Lake City, Utah

THE other day, a man brought to my office his ten-year-old son, who complained of a toothache. On examination I found that both lower permanent molars were badly decayed, with exposure of the pulp. The father thought that these were "baby teeth" and wanted them extracted.

The same day, a woman brought in her five-year-old daughter to have some teeth extracted. This time, it was to be all four lower deciduous molars. You say, "What is so unusual about that?" I reply, "Nothing"; and that is the tragic thing about it. Day after day, year after year, this has been going on and, to my knowledge, little has been done about it, until very recently. It has been only in the last few years that we, as dentists, of the United States, have made any definite or concerted effort to educate the public in dental health. Is this our duty? Before I answer, let me tell you a short story.

The great fire of 1866 destroyed the central part of London and laid a large number of its churches in ruins. It completely gutted the old St. Paul's Cathedral and made necessary the present building. This was the opportunity for Sir Christopher Wren, the architect, to whom London owes much for what is finest in its architecture and especially in the character of its central churches. He received for his compensation a salary less than that of an American unskilled worker, but, as his epitaph truly says, "his work was not for his own but for public good," and will keep bright his fame forever.

One morning, he passed among the workmen, most of whom did not know him, and of three different men engaged in the same kind of work, he asked the same question: "What are you doing?"

From the first, he received this answer, "I am cutting this stone."

From the second, the answer was: "I am earning three shillings and sixpence a day."

But the third man straightened up, squared his shoulders and holding his mallet in one hand and the chisel in the other, proudly replied: "I am helping Sir Christopher Wren build this great Cathedral."

Fig. 1.—Portable collapsible exhibit cases used by Salt Lake City dentists.

These are three ways of looking at your chosen profession.

Are you just plugging holes in teeth? Are you just working for the almighty dollar? Or are you doing a small part of a great work? Doing your share to

aid humanity to build better bodies, to curtail suffering, to maintain health and to make this world a better place in which to live?

So my answer to the first question is: If you, a member of the American Dental Association, are staying in your office day after day doing only the necessary repair and replacement that comes to you, you are doing one of the two things implied in the first two statements and are shirking a most important duty imposed on you by your degree of doctor.

I do not mean that one should impose himself on every public or private gathering, exploiting himself and his wares like a common quack; but I do believe that there is an ethical means of educating the public, that each and every one may cooperate without lowering the dignity of our profession or being accused of unprofessional conduct.

As a member of the Public Relations Committee of the Utah State Dental Association, I submit the plan we initiated six years ago and are expanding each year.

Our first endeavor was a series of ten lectures given to the student nurses of two of our largest hospitals. These lectures were on the following subjects and were treated as nearly as possible from the nurses' standpoint.

Decay is a disease, and food no matter how clean, is contaminated when chewed by decayed teeth.
Painful, decayed teeth prevent proper chewing and thus interfere with the normal intake of food.
To consider children's teeth temporary and treat them as is usual is considering life itself temporary.

Fig. 2.—Close-up of exhibit case showing models and charts.

1. (a) Definition of dentistry and its field of operation.

(b) Embryology of face and dental organs.

(c) Congenital malformation, harelip, cleft palate, etc., and their treatment.

(d) Malformation due to other conditions (orthodontia).

2. Bacteria of the mouth; systemic diseases and their manifestations in the mouth.

3. The care of the child and its deciduous teeth.

4. The care of the mouth. Oral hygiene. Relief of pain.

5. (a) Radiology; its value.

(b) Systemic effect of mouth disease.

6. Dental anatomy and histology.

7. Diet and dental health.

8. Extractions and their treatment.

(a) Anesthetics and premedication.

9. Fractures and other facial injuries.

10. (a) Ethics; physician, dentist, nurse and patient relationship.

(b) Dental organizations.

Thereafter, a written examination was conducted.

The success of this endeavor led to its adoption by the four hospitals of Salt Lake City the following year and the same series was given to the school nurses. Last year, the series was changed from ten to nineteen lectures, and plans are under way to give the same series to the state nurses' alumni association.

Also, we have given a series of lectures to parent-teacher associations on the care of children's teeth; oral hygiene; dentistry and its relation to systemic diseases; dental health and the expectant mother, and diet and dentistry.

A sponsor was obtained and twenty-three fifteen-minute talks were given over station KSL. Copies of these talks were mailed to the many listeners requesting them.

Our lectures have called for charts, slides, movies, models, etc., which we are gradually accumulating. The film entitled "The Life of a Healthy Child," supplied through the cooperation of the state health department, has been shown to upwards of 50,000 people.

One of the necessary adjuncts to our work was the display of models. Two cabinets were built as shown in the accompanying photographs. These are 2 by 4 feet, 4 inches front and 7 inches back, inside depth, with glass top and protecting lid. They are made with folding legs so that they may be easily collapsed and carried by one man as a suitcase. The lids are used for educational charts and pictures and the inside is nicely arranged with models showing normal and abnormal mouth conditions, orthodontia cases before and after correction and various comparative educational models and x-ray films with explanatory notes beneath each model. (Figs. 1-2.)

These were built so that they could be handled by one man, placed in an ordinary passenger car and easily set up and taken down in a short time.

We have placed these exhibits in public libraries, state and county fair buildings, schools, university exhibit halls and wherever else we could find a place to show them. They were built at a cost of $26 each and have proved their value. A librarian stated that the exhibit created more interest than any other exhibit placed in the public library for years.

Last year, we were permitted to appear in each of the twelve high schools. Each Monday morning, the exhibit cases were set up in the hallway of the high school and left for the remainder of the week. During the week, our organization provided an educational talk to each of the physical health classes of the school. This consisted of six or seven lectures to groups of forty to seventy-five and so reached almost every student in the school. We attempted to cover the subject of the relation of teeth to personality and health.

This year, we are returning with an improved program. Another project was the sponsoring of the Winnebago Magic Show, sent out by the Good Teeth Council for Children, Inc., Chicago. This show was given in four schools in the vicinity of Salt Lake City, the dental association arranging its schedule and the expenses met by the parent-teacher association. It was a real success. This year, this show will return and cover almost the entire state, the Dental Division of the Utah State Board of Health, under R. L. Dalgliesh, the various dental societies, the board of education and the parent-teacher's association all cooperating to make it a success.

In all this work, we have endeavored to be ethical. No man is permitted to exploit his own work. He is introduced simply as a member of the Utah State Dental Association and we are doing our best to teach only accepted theories.

Exhibit of Isaac Schour, D.D.S., University of Illinois, College of Dentistry, winner of first place in Division A, Scientific and Health Exhibit Section, Atlantic City, N. J., July 1937.

A.D.A. RADIO PROGRAM OVER COLUMBIA BROADCASTING SYSTEM

Through the cooperation of the Columbia Broadcasting System, the American Dental Association's weekly radio programs are being made available to the following stations at 1:15 p.m., Central Standard Time:

WBRC—Birmingham, Ala.
WALA—Mobile, Ala.
KLRA—Little Rock, Ark.
WJSV—Washington, D. C.
WMBR—Jacksonville, Fla.
WQAM—Miami, Fla.
WDBO—Orlando, Fla.
WDAE—Tampa, Fla.
WJNO—West Palm Beach, Fla.
WTOC—Savannah, Ga.
WOC—Davenport, Iowa
KRNT—Des Moines, Iowa
WKBB—Dubuque, Iowa
KSCJ—Sioux City, Iowa
WIBW—Topeka, Kan.
KFH—Wichita, Kan.
KWKH—Shreveport, La.
WCCO—Minneapolis, Minn.
WCOC—Meridian, Miss.
KMOX—St. Louis, Mo.
KFAB—Omaha, Nebr.
WBT—Charlotte, N. C.
WBIG—Greensboro, N. C.
WSJS—Winston-Salem, N. C.
WHIO—Dayton, Ohio
KOMA—Oklahoma City, Okla.
KTUL—Tulsa, Okla.
WHP—Harrisburg, Pa.
WAIM—Anderson, S. C.
WNAX—Yankton, S. D.
KNOW—Austin, Texas
KRLD—Dallas, Texas
KTRH—Houston, Texas
KTSA—San Antonio, Texas
WACO—Waco, Texas
KGKO—Wichita Falls, Texas
WDBJ—Roanoke, Va.
WMMN—Fairmont, W. Va.
WTAQ—Green Bay, Wis.
WISN—Milwaukee, Wis.
WMBD—Peoria, Ill.

DENTAL ECONOMICS

A STATE HEALTH OFFICER LOOKS AT PUBLIC HEALTH DENTISTRY

By Carl V. Reynolds, M.D., Asheville, N. C.

A DIVISION of oral hygiene or dental health has a very definite place in every public health set-up. A program of mouth health teaching, conducted in the public schools of a state by licensed dentists in cooperation with the county health departments and school officials and dedicated to the betterment of individual and public health, has great possibilities. In North Carolina, where such a program has been in operation long enough for some of its good results to be seen and appreciated, we are convinced that dentistry is a profession which can and will make a great contribution in the field of public health.

Any disease which affects a large proportion of the population is a subject of vast importance from a public health point of view. Approximately 85 per cent of the American people are suffering from decayed teeth and diseased gums. Considering the teachings of the physicians in regard to focal infection and of the dentists as to the dangers from oral sepsis, spreading the gospel of mouth health is a big task in public health. We are glad to say that both physicians and dentists are awakening to their responsibilities and opportunities in this field, which, it must be admitted, has been too long neglected. Dentistry is being recognized as never before as a mighty force in the public health battle against mankind's most dreaded enemy, disease.

Public health medicine, in its true sense, is preventive medicine. This being true, public health dentistry is preventive dentistry. The prevention of decay of the teeth and disease of the gums and the many ills resulting therefrom can, we believe, be best accomplished by directing our efforts toward reaching the children in the lower grades through mouth health education programs in our public schools.

The purpose of the mouth health programs is twofold: The primary purpose is educational, that all children in the public schools of the state, regardless of financial rating or social standing, may be taught, by dentists especially trained in public health dentistry, the necessity for clean, healthy mouths and the great dangers which lie hidden in diseased and ill-kept mouths. These children are instructed in the proper use of the toothbrush and what this implement may mean in the preservation of a healthy entrance to the digestive tract. The value of the proper diet and the foods that one must eat to have strong well-formed teeth capable of resisting decay are stressed. Great emphasis is laid on the development of the teeth and how a tooth in a pathologic condition may, as a focus of infection, prove detrimental to the entire system. The importance of periodic visits to the family dentist is never overlooked.

The secondary purpose of this activity is to make as many corrections as possible for the indigent class of children. This may be termed demonstrative teaching. Term it what you may, this work is add-

ing much to the physical comfort and happiness of thousands of underprivileged children in this state every year, clearing their minds and making study a pleasure instead of a bore. Many children who cannot afford the services of a private dentist are suffering from the ill effects of diseased mouths. It is the policy of the school dentists to correct these conditions, as far as possible, for these unfortunates and to make of them respectable, able citizens who can afford and appreciate the art and science of dentistry. While a child may belong to the indigent class today, he may be a leading citizen in his community tomorrow. He will be a representative of the opportunities made possible for him in his childhood by the teachers of public health. It is the duty of the public, of public health authorities and the dental profession to remove any obstacles that may prove detrimental to the health of the indigent children and possibly rob them of the position they deserve in society.

These things, of course, cannot be accomplished in a day. Their consummation will take years. The seed has been planted and the tree is bearing fruit. "A good tree cannot bring forth bad fruit."

Many men in North Carolina realize the importance of this work and are using their every effort to further the cause. These men are directly responsible for saving many children, each year, from lives of misery caused by preventable oral diseases, which, if left uncorrected, might through physiologic and psychologic defects lead to lives of crime or to insanity.

AN ANALYSIS OF TWO NATION-WIDE DENTAL SURVEYS

By Frank C. Cady,* D.D.S., C.P.H., Washington, D. C.

THE two reports under discussion are, first, "A Dental Survey of School Children Ages 6-14 Years Made in 1933-1934 in Twenty-Six States," by members of component societies of the A.D.A. and compiled and published by the U. S. Public Health Service as P. H. Bulletin No. 226; and, second, "A Survey of Dental Activities of State Departments and Institutions of the United States," conducted by the U. S. Public Health Service and published as Public Health Bulletin No. 227.

(Read before the Section on Children's Dentistry and Oral Hygiene at the Seventy-Ninth Annual Session of the American Dental Association, Atlantic City, N. J., July 15, 1937.)

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PURPOSES OF THE SURVEYS

For a clear understanding of the purposes of these surveys, it is essential to present a short history of events leading up to their undertaking.

At the 1932 meeting of the American Dental Association, in Buffalo, N. Y., an interested group of members prepared a resolution recommending that the Association sponser a survey of existing public dental facilities in state, county and municipal health organizations.

This resolution was submitted to the House of Delegates at this Session and was passed by them. The incoming President, Dr. G. Walter Dittmar, appointed a committee of twenty-five members to develop the plans to conduct the survey. Since the Association did not have ade-

quate funds to make the study, Dr. Dittmar and the committee appealed to the Surgeon General of the U. S. Public Health Service for assistance. A meeting to consider the matter, held in Washington in April 1933, was attended by the executive council of the committee, the Surgeon General and his assistants, and a specially appointed committee from the Association of state and provincial health authorities.

At this conference, the Surgeon General agreed to detail officers to make a survey of public dental facilities of state departments and institutions and, at the same time, suggested that the American Dental Association sponsor a survey to determine, on a nation-wide basis, an estimate of the dental defects existing among the people. This matter of dental defects was discussed at length, and it was decided to submit to the next meeting of the House of Delegates a resolution that the American Dental Association sponsor a survey of an adequate sample of the elementary school children of the nation, since it was believed that this group, by virtue of its accessibility during the school term, would lend itself most readily to the object and give a fairly accurate picture of the dental status of the people. It was agreed that the Public Health Service would administer this survey and that the members of the American Dental Association, through component societies, would be asked to make the examinations. The House of Delegates passed this resolution at the Chicago meeting in 1933 and the survey was completed in 1934.

Since the facilities for handling a need are necessarily dependent on that need, it is logical to consider the findings of the dental survey of school children first.

THE DENTAL SURVEY OF SCHOOL CHILDREN

In the analysis of data collected, regardless of the methods employed, a number of basic facts must be examined and evaluated before any sound conclusions can be drawn. In the survey of the dental needs of elementary school children, these facts may be conveniently set down in the form of questions, as follows:

1. Is the geographical distribution of the examinations representative of the United States as a whole?

2. May the individuals examined be considered representative of the whole population?

3. Is the sample chosen of sufficient size as regards age, sex, color and urban and rural distribution to be representative of the entire group of elementary school children?

4. Were the methods of making the examinations satisfactory as regards time, physical equipment, lighting, recording of findings and diagnosis?

A glance at the spot map, page 1881, of the geographical distribution of the sampling, by counties, will show sufficient dispersion to be representative of a greater part of the country. Twenty-six states are represented with a total of 648 counties.

In a survey of this magnitude wherein unpaid, volunteer workers are making the observations, it is very difficult to get an even distribution of results. It must also be borne in mind that in this country the population is not evenly distributed. The western states are large in area and sparsely settled, and many counties have insufficient population to support a dentist. In the survey of Utah, Colorado and the Dakotas, many of the examiners traveled long distances. The spot map will show that the geographical distribution by counties in the states of Pennsylvania, Indiana, Minnesota, North Dakota, Tennessee, Georgia, New Jersey, Nebraska, Oklahoma and Utah was probably satisfactory. In the remaining states, on the other hand, the dispersion was either questionable or entirely unsatisfactory.

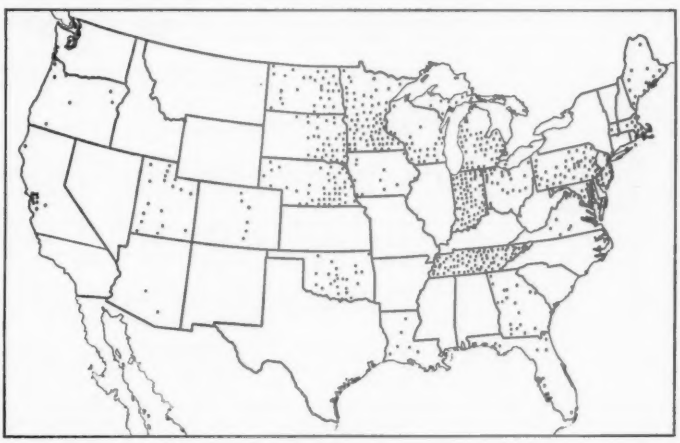
As regards the second question, there may be a difference of opinion as to whether a well-distributed sample of the school population between the ages of six and fourteen is an adequate repre-

sentation of the whole population. It is a fact that the sample examined is included within the age group most susceptible to dental caries, but does not include the ages having the highest incidence of investing tissue diseases. In this instance, the Public Health Service and the American Dental Association had little choice of subjects for the study, since the school age group was the only one readily available.

It is doubtful that any one would claim that a cross-section examination of the school population would give a true picture of the dental status of the entire population. However, if the surviving members of this group were to be examined in the middle span of life and filled permanent teeth be computed as previous dental caries, it is reasonable to assume that this rate would be higher than the rate previously found. By this premise, it is logical to assume that the number of dental defects of a representative age sample of the entire population would be higher than that found in the school-age group. How much higher is of course a matter for speculation, because of the absence of a reasonable number of reliable data.

Since the elementary school group was chosen for this survey, was the sample examined representative? A brief analysis of some of the data collected and tabulated will throw some light on the subject.

A study of Table 1 (Table 2 of the report), which shows the distribution of the examinations classified according to color, age, sex and percentage of estimated population, reveals that the groups examined in the states of Indiana, Minnesota, New Jersey and Tennessee are adequate in all four categories and that the remaining states are probably deficient in one or more of them.



Map showing distribution of sampling.

A study of Table 3 of the report will show that while the percentage of the number of counties in some states was sufficient to be representative, an insufficient number of examinations was made in a majority of these counties to be representative. The State of Georgia is a case in point. Examinations were made in twenty Georgia counties, 12.4 per cent of the total number in the state, but the percentage of children examined in the twenty counties averaged only 1.96, the range being from 0.6 to 4.2. This, of course, is an inadequate sample of that state.

TABLE 1.—DISTRIBUTION OF EXAMINED CHILDREN OF TWENTY-SIX STATES ACCORDING TO COLOR, SEX AND AGE; PERCENTAGE OF ESTIMATED POPULATION, AGES SIX TO FOURTEEN EXAMINED IN EACH STATE*

State	Number of Children Examined																		Estimated Population of States Ages 6-14 Per Cent		
	White									Colored											
	Male				Female				Total White	Male				Female				Total Colored	Total Both Colors			
	All Ages	6-8 Years	9-11 Years	12-14 Years	All Ages	6-8 Years	9-11 Years	12-14 Years		All Ages	6-8 Years	9-11 Years	12-14 Years	All Ages	6-8 Years	9-11 Years	12-14 Years			White	Colored	Total
1. Arizona	1,422	425	560	437	1,342	410	592	340	2,764	0	0	0	0	0	0	0	0	0	2,764	6.1	0	5.9
2. California	4,550	1,257	1,579	1,714	4,431	1,253	1,559	1,619	8,981	51	18	16	17	60	20	20	20	111	9,092	1.3	1.1	1.3
3. Colorado	7,884	3,150	3,633	1,101	7,581	3,076	3,574	931	15,465	188	111	67	10	160	78	73	9	348	15,813	9.3	25.3	9.4
4. Florida	10,075	3,871	4,488	1,716	9,389	3,806	4,265	1,318	19,464	408	140	160	108	450	163	185	102	858	20,322	10.4	1.1	7.7
5. Georgia	2,257	671	948	638	2,166	644	947	575	4,423	0	0	0	0	0	0	0	0	0	4,423	1.2	0	0.7
6. Indiana	117,900	38,413	44,258	35,229	112,600	37,346	42,932	32,322	230,500	2,087	728	752	607	2,028	713	768	547	4,115	234,615	43.4	25.0	42.9
7. Iowa	8,516	3,016	3,351	2,149	8,068	2,947	3,286	1,835	16,584	68	23	38	7	53	22	23	8	121	16,705	3.9	4.5	3.9
8. Louisiana	1,537	562	551	424	1,567	602	594	371	3,104	51	12	19	20	59	20	21	18	110	3,214	1.2	0.07	0.8
9. Maine	6,108	1,994	2,290	1,824	6,034	2,006	2,336	1,692	12,142	0	0	0	0	0	0	0	0	0	12,142	8.9	0	8.8
10. Maryland	4,336	1,642	1,721	973	4,040	1,585	1,645	810	8,376	174	19	28	127	30	7	17	6	204	8,580	3.6	0.4	3.0
11. Massachusetts	8,900	2,987	3,177	2,736	8,677	2,990	3,129	2,558	17,577	101	16	47	38	129	18	66	45	230	17,807	2.5	2.6	2.5
12. Michigan	27,005	9,245	10,159	7,601	25,882	8,910	10,180	6,792	52,887	319	134	113	72	319	138	131	50	638	53,525	6.5	2.8	6.4
13. Minnesota	104,116	35,030	38,777	30,309	99,568	34,182	38,003	27,383	203,684	296	107	115	74	306	95	121	90	602	204,286	44.7	51.9	44.7
14. Nebraska	14,103	4,470	5,558	4,075	13,739	4,368	5,463	3,908	27,842	218	91	67	60	255	83	93	79	473	28,315	11.3	26.2	11.4
15. New Jersey	127,818	40,313	47,519	39,986	123,515	39,688	46,602	37,225	251,333	8,183	2,746	2,963	2,474	8,615	2,855	3,119	2,641	16,798	268,131	38.1	52.1	38.8
16. North Dakota	10,852	3,457	4,088	3,307	10,417	3,311	3,936	3,170	21,269	0	0	0	0	0	0	0	0	0	21,269	15.1	0	15.1
17. Ohio	12,328	4,042	4,908	3,378	12,060	3,985	4,874	3,201	24,388	595	203	218	174	637	215	260	162	1,232	25,620	2.3	2.6	2.3
18. Oklahoma	8,895	2,793	3,575	2,527	8,640	2,789	3,468	2,383	17,535	523	147	201	175	619	159	248	212	1,142	18,677	4.1	3.3	4.0
19. Oregon	4,473	1,254	1,730	1,489	4,316	1,218	1,687	1,411	8,789	33	6	15	12	17	6	9	2	50	8,839	6.0	21.7	6.1
20. Pennsylvania	34,475	11,989	15,034	10,452	26,503	11,552	15,544	9,407	73,978	776	373	219	184	628	260	223	145	1,404	75,382	4.3	2.1	4.2
21. South Dakota	17,423	5,493	6,514	5,416	16,860	5,335	6,414	5,111	34,283	0	0	0	0	0	0	0	0	0	34,283	25.8	0	25.8
22. Tennessee	105,442	31,974	40,718	32,750	105,377	32,080	40,697	32,600	210,819	20,032	5,881	7,658	6,493	21,626	6,555	8,167	6,904	41,658	252,477	48.4	46.9	48.1
23. Utah	7,876	2,879	3,706	1,291	7,345	2,846	3,595	904	15,221	0	0	0	0	0	0	0	0	0	15,221	14.2	0	1.42
24. Virginia	13,261	4,542	5,400	3,319	12,627	4,500	5,270	2,857	25,888	5,591	1,526	2,126	1,939	6,086	1,737	2,340	2,009	11,677	37,565	7.3	7.9	7.5
25. West Virginia	229	64	118	47	282	75	148	59	511	53	24	15	14	59	18	22	19	112	623	0.1	0.5	0.2
26. Wisconsin	24,875	8,622	9,697	6,556	23,753	8,372	9,346	6,035	48,628	0	0	0	0	0	0	0	0	0	48,628	9.4	0	9.4
Total	689,656	224,155	264,057	201,444	666,779	219,876	260,086	186,817	1,356,435	39,747	12,305	14,837	12,605	42,136	13,162	15,906	13,068	81,883	1,438,318	12.0	7.9	11.6

*From Public Health Bulletin No. 226.

Table 3 (Table 4 of the report) shows in summary the number and percentage of children examined in each state, and Table 5 of the report shows this distribution by states. It was considered impracticable to present these tables as they are too detailed for a short study. Those interested can peruse them at their leisure in Bulletin No. 226. Of the total number of 648 counties in which examinations were held, eighty-two counties examined 60 per cent or more of their school population, 132 examined from 40 to 60 per cent, and 194, or 30 per cent of the total number, examined fewer than 10 per cent of their school children. It is worthy of note that counties in the states of Indiana, Minnesota, New Jersey and Tennessee constituted sixty of the eight-two in the first group, and ninety-nine of the 132 counties in the second, or from 40 to 60 per cent group. The number of children examined in these four states represented 67 per cent of the grand total of children examined.

In an effort to separate the children examined into urban and rural types, the communities that returned the schedules were classified into five groups according to their 1930 population. The smallest group contained under 5,000 population and the largest 100,000 and over. Tables 6, 7 and 8 of the report show this distribution. A study of the tables will show a fairly even distribution in those states which furnished an adequate sample. The number of communities represented in the five population groups vary considerably in each state, but so also do the types of communities vary. For example, New Jersey is a small congested state with a preponderance of the larger communities; whereas Minnesota and Tennessee are larger in area, with a more scattered population.

Table 2 shows the distribution of the examinations in the four states of Indiana, Minnesota, New Jersey and Tennessee according to the size of the community. It will be noted that New Jersey has the largest representation in the Class A, or most populous, communities, and Tennessee in the Class E, or least populous, communities.

As concerns our third question, having to do with the size of the sample and the age, sex, color and rural and urban distribution, we can safely say that the states

TABLE 2.—DISTRIBUTION OF CHILDREN EXAMINED IN THE FOUR STATES IN WHICH MORE THAN TWO-THIRDS OF THE TOTAL EXAMINATIONS WERE MADE ACCORDING TO SIZE OF COMMUNITY IN WHICH THEY LIVED

State	Total Children Examined	Children Examined in Communities with Indicated Population									
		A: 100,000 and Over		B: 25,000-99,999		C: 10,000-24,999		D: 5,000-9,999		E: Under 5,000	
		Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
Indiana	234,615	35,231	15.0	41,063	17.5	21,538	9.2	13,670	5.8	123,113	52.5
Minnesota	204,286	48,862	23.9	0	0	19,164*	9.4	11,073*	5.4	125,187	61.3
New Jersey	268,131	116,856	43.6	50,325	18.8	40,439	15.1	29,853	11.1	30,658	11.4
Tennessee	252,477	54,736	21.7	3,729	1.5	4,155	1.6	13,644	5.4	176,213	69.8
Total	959,509	255,685	26.6	95,117	9.9	85,296	8.9	68,240	7.1	455,171	47.5

*No colored examined.

*From Public Health Bulletin No. 226.

of Indiana, Minnesota, New Jersey, Nebraska and Tennessee fulfil these requirements and that the states of Nebraska, North Dakota, South Dakota and Utah comply fairly well, with the exception of

sent questionnaires to each of the 746 supervisors. Sixty-seven per cent were returned and 98 per cent of the returned questionnaires stated that the examiners were dentists and the remainder were

TABLE 3.—PERCENTAGE OF BOYS AND GIRLS OF DIFFERENT AGES WITH CARIOUS DECIDUOUS AND CARIOUS PERMANENT TEETH, SUMMARIZED BY STATES*

	Deciduous Teeth						Permanent Teeth					
	Boys			Girls			Boys			Girls		
Ages in Years	6–8	9–11	12–14	6–8	9–11	12–14	6–8	9–11	12–14	6–8	9–11	12–14
Total, 26 States	54.9	24.1	3.2	53.9	20.0	2.1	36.3	60.7	70.8	40.5	62.8	71.4
State												
Arizona	56.2	36.8	3.4	56.5	31.8	5.3	19.8	35.9	52.2	20.9	40.9	61.4
California	59.6	43.0	4.2	58.6	32.2	3.0	21.6	47.2	62.9	26.7	50.3	63.3
Colorado	57.1	37.1	8.1	55.1	30.6	5.9	28.0	48.2	59.2	29.8	52.0	61.6
Florida	57.0	29.7	5.6	55.2	25.0	4.5	29.2	51.4	64.3	31.4	55.1	66.0
Georgia	54.0	29.7	5.4	54.1	27.3	1.6	30.6	50.1	54.4	31.6	49.4	56.9
Indiana	53.7	21.8	3.1	52.9	18.5	2.3	33.0	59.3	69.4	37.8	61.4	69.8
Iowa	60.0	29.7	3.5	57.5	23.9	2.4	31.1	53.3	64.3	34.4	56.7	65.3
Louisiana	45.8	21.3	1.9	40.0	15.7	2.5	32.1	56.9	68.4	29.0	57.8	67.4
Maine	56.8	15.5	1.6	57.7	14.0	0.9	46.5	71.7	80.8	50.8	73.6	80.9
Maryland	62.1	28.9	5.2	61.3	22.7	4.6	35.4	61.9	71.8	38.3	64.0	70.2
Massachusetts	49.5	18.6	2.0	48.2	15.3	0.8	45.3	69.4	78.9	48.7	68.2	78.1
Minnesota	52.2	18.3	2.1	51.7	15.5	1.5	34.7	59.1	68.1	38.8	59.7	68.1
Michigan	54.7	21.6	2.4	54.6	18.3	2.1	36.5	60.6	72.1	39.1	62.0	71.5
New Jersey	59.7	28.1	3.5	58.9	23.2	2.2	43.3	70.9	79.3	47.8	73.0	79.9
North Dakota	57.4	23.8	3.7	57.6	21.3	2.7	34.4	64.2	74.6	38.4	65.5	74.1
Ohio	57.7	26.6	3.3	54.3	24.8	2.8	39.7	60.9	75.1	42.2	64.1	75.2
Oklahoma	54.1	22.7	2.9	51.4	18.0	2.0	23.4	44.5	53.2	27.4	48.0	55.4
Oregon	64.0	34.3	5.9	64.0	30.2	3.2	37.6	58.6	70.4	45.6	58.3	72.9
Nebraska	61.1	30.9	4.8	59.5	25.4	3.8	29.2	56.6	69.5	34.3	59.0	69.6
Pennsylvania	47.9	17.7	2.6	47.2	14.7	1.7	50.4	73.2	81.3	56.1	74.8	82.4
South Dakota	48.8	21.6	2.9	48.0	18.4	1.7	27.5	51.6	63.2	31.3	55.6	63.6
Tennessee	50.2	25.5	3.5	48.0	20.5	1.9	31.6	51.6	62.6	34.7	54.6	64.6
Utah	66.8	29.0	4.7	66.4	23.9	3.4	36.1	62.2	67.2	40.9	64.5	70.9
Virginia	59.2	23.1	2.9	60.0	18.6	1.9	30.0	49.7	65.2	33.8	52.7	63.8
West Virginia	30.0	10.2	6.4	22.7	5.4	1.7	26.6	44.1	51.1	45.3	63.5	71.2
Wisconsin	62.4	27.5	3.5	62.3	23.5	2.1	45.4	70.8	80.3	51.0	72.1	80.0

*Prepared by Senior Statistician William M. Gafafer, U. S. Public Health Service.

an adequate sample of their colored population.

The next item for consideration concerns the competency of the personnel who made the examinations. To determine this, the U. S. Public Health Service nurses, dental hygienists or teachers.

The last category having to do with the methods of making the examinations as regards time, physical equipment, lighting, recording of findings and efficient diagnosis is more difficult to meas-

ure on account of the personal equation. The returned schedules revealed that a majority of the examinations were made in schoolrooms and, in some sections, a minimum amount of time was available.

The questionnaires also showed that 98 per cent of the examiners used mouth mirrors and explorers and that 60 per cent of the examiners did not count pits and fissures as caries.

If a conclusion can be drawn from a study of the findings of these questionnaires, it is that the examinations were made, in the most part, by the most representative and competent personnel available.

It is possible to summarize the reported data by states from what has been said about the collection of the data. This is a doubtful procedure and nothing can be said about the reliability of the results. However, the results may give some indication of high and low caries areas. A summary by states has been made with respect to white boys and girls of different ages with carious deciduous and carious permanent teeth. These results were obtained subsequent to the publication of Bulletin 226.

If the percentages obtained in the summary by states appear to be low, it must be borne in mind that only open caries in deciduous and permanent teeth were computed. If filled teeth had been included, the percentages would be higher.

No attempt has been made to consolidate the age groups, since this would mask the effect of age. Thus, Table 4 shows that the small percentages of decayed deciduous teeth in the twelve to fourteen year old group and the small percentages of decayed permanent teeth in the six to eight year group would give a false picture if averaged with the corresponding percentages of the other ages. Obviously, these small percentages are due to the small number of permanent teeth in the younger group and the small number of deciduous teeth in the older group.

As will be noted, the trend of the percentages in both groups is fairly constant. The grand totals show a slightly higher percentage of decayed deciduous teeth among the boys and a slightly higher percentage of decayed permanent teeth among the girls.

Of the twenty-six states included in the report, New Jersey ranked first in the fulfilment of all the criteria considered essential for a reliable report of existing conditions. In this state, only dentists made the examinations and two-thirds of them counted pits and fissures as caries. New Jersey's highest rates were 59.7 per cent for deciduous teeth of six to eight year old boys and 79.3 per cent for permanent teeth of twelve to fourteen year old boys. Six states found higher rates for deciduous teeth and three for permanent teeth. The New Jersey rates are 4.8 and 8.5 per cent higher than the general averages for those age groups. This means that New Jersey either has a higher caries rate than the rest of the country or that its examinations were more thorough and complete. A careful study of the report will incline one, perhaps, to the latter view.

This bulletin together with the summary table is the best indication we have at present of the magnitude of the problem of dental caries among the elementary school children of the nation.

SUMMARY

1. The survey was conducted in 648 counties of twenty-six states. In eleven of these states, the geographical distribution was adequate.

2. A study of the report shows that the states of Indiana, Minnesota, New Jersey, Tennessee and probably Nebraska, Utah, North Dakota and South Dakota examined a representative sample of their school-age group of sufficient size and variety as regards age, sex and urban and rural distribution. All of this group except Utah and the Dakotas included an adequate percentage of their colored population.

3. The report shows that 98 per cent of the examinations were made by dentists in all parts of the country. These dentists were members of their dental societies. Their service was voluntary and without pay. Undoubtedly, they are representative of the best type of the profession in their communities and the best examining personnel available.

4. In a survey so large, no conclusions can be drawn regarding the methods of making the examinations as affected by time, equipment, lighting and recording. No standards of measurement were set up and many variables were undoubtedly operating. If standardized methods had been established and maintained, perhaps more, not fewer, defects would have been found and recorded.

5. For reasons previously stated, the caries rates for New Jersey may be considered a good average indication of the prevalence of dental caries among elementary school children. Until observations are made on other age groups, these figures will have to serve as a guide.

6. No accurate comparisons can be made among states, communities or other units. This would be possible only if methods of measurement were carefully standardized and the samples carefully chosen. In the total number of examinations, this survey was much larger than necessary to obtain an accurate estimation of the percentage of dental defects among a group of the population.

A SURVEY OF ACTIVITIES IN STATE DEPARTMENTS AND INSTITUTIONS

The survey of elementary school children demonstrates the high rate of dental defects among them. Their dental condition reflects in a measure the dental status of the general population.

From a public standpoint, the survey of activities shows the facilities available in the period from 1928 to 1933 to cope with the situation. Owing to the stimulus of the funds provided by the Social Securities Act, the facilities in health departments of many states and some cities have greatly increased in the past year.

A majority of these organizations provide only dental health educational service. A few furnish a limited amount of clinical service to selected groups of preschool and school children, as well as educational service. Public Health Bulletin 226 does not show the amount of service furnished school children by individual schools and school systems. That it far exceeds in amount that supplied by health departments was shown in a survey made in 1930 by the United States Office of Education.

Even a casual study of this report shows marked diversity of organization and a lack of accurate records and reports. Few dental units in state health departments have administrative methods in common or have their expenditures budgeted and itemized. From the the records of the majority, it is difficult to see how they can accurately measure their achievements from year to year.

It is quite apparent that dental service in most state institutions is largely a hit-and-miss affair. There is no professional administrative control and no attempts made at cost accounting.

This report shows a distinct need for better administrative control and more accurate and uniform records in all dental health organizations. As a means for improving their methods and technics, state health officers have their state and territorial association. If the dentists in public health work would organize a section in this or some other health body, it would, I believe, be profitable.

It will be apparent to the most casual observer that the combined educational and clinical facilities of governmental and private practice are unable to cope with the high rate of dental defects among the people of this country and that more and better methods will have to be instituted by the dental profession if the number of dental cripples is to be materially reduced.

DISCUSSION

H. Shirley Dwyer, New York City: As the discussion is limited to the excellent analysis we have just heard, and not to the subjects analyzed, I shall adhere as closely as possible to the outline and sequence established by Dr. Cady.

Our previous speaker quite correctly divided his discussion into the four principal headings: (1) distribution, (2) representative sampling, (3) adequate sampling and (4) reliability and examination technic. I am inclined to agree with most of Dr. Cady's findings. In the circumstances, the distribution was probably as general and as nearly uniform as could be expected considering the population distribution. At the same time, there is a rather interesting point which seems worth raising.

In an examination conducted a few years ago, we found that the children of rural sections adjacent to New York City, that is, within the fifty mile limit, showed an average incidence of decay of seven cavities per child. Pits and fissures were counted as defects, but not as cavities. During the same period, an examination of New York City children showed but five plus cavities per child, the same examination technic and recording being used. It would be absurd to say that these children had received any greater degree of dental service, as even our thorough service program can merely scratch the surface of a school child population which runs up to a million and a half children.

In a close perusal of Dr. Cady's paper, I fail to find anything which would enlighten us on this interesting point. Of course, the most probable explanation is that New York City children have been exposed to a greater amount of dental health education than have the rural group. As far as economic status is concerned, certainly the rural group were far superior to the city group. This naturally leads us to a consideration of the adequacy and representative phase of the sampling.

Certainly as far as numbers are concerned, we agree that the quantity for statistical purposes was sufficient to reduce variables to a minimum. With the number of children examined, deviations due to unusual circumstances existing in a particular locality should not materially affect the findings. We do find, however, that the State of New Jersey showed the highest percentage of children examined in communities of 100,000 or more (Table 9, Public Health Bulletin No. 226), but that in the four states showing greatest returns "nearly half lived in towns and rural areas, and over one fourth in cities of 100,000 or over." Is it not possible that this would lead to a bias in the final tabulations? Again, we wonder whether it would not have been of interest if Dr. Cady could have given us some further information in his analysis, on a comparison between the rural and city returns.

We fail to agree completely with Dr. Cady therefore when he says that "a study of the tables will show a fairly even distribution in those states which furnished an adequate sample." Let us take Table 6 of the report as an example. New Jersey is named as a state which supplied adequate material. We find that, according to Table 6, out of eighty-one communities, six were in the 100,000 population group, as against seventy-five communities with a lower population group. This would be approximately only 7 per cent in urban areas. The other tables do not vary greatly from this same grouping. If we consider it from the point of view of number of children examined, again we find that, except for New Jersey, we have a preponderance of the examined children living in rural areas, even New Jersey showing only 43 per cent in urban districts.

Considering the great variance which we found between rural and urban children, this would seem to be of some importance. This may have been a purposeful distribution on the part of those

conducting the examination, but, if so, it should be so stated in the report. The third question raised in Dr. Cady's paper was whether the sampling was representative. As far as it goes, yes. The failure to include more urban areas was discussed under the adequacy of the sampling.

Dr. Cady had some difficulties apparently in keeping these two divisions entirely separate, so it is surely pardonable for me to err along the same lines. I should, however, like to call his attention to the voluminous writings of Thaddeus P. Hyatt relative to caries liability of adults, and also to the book called "Health Dentistry for the Community," in which further information is available relative to adult dental conditions. Especially are the findings of Hyatt acceptable as reliable data. We call the attention of Dr. Cady to this because he mentions in his paper that there are no reliable data available relative to the incidence of caries in adults.

The fourth division relative to the reliability due to examination technic is the weak spot of the entire program.

From a strictly scientific point of view, that survey is almost useless. As a general picture which might permit of a later comparison with an equally general picture, it is good; but it does not meet the requirements of a truly scientific piece of work. You and I were taught when we went to elementary school that we could not subtract pears from apples, and yet years after, under the guise of research, that is exactly what we try to do.

We cannot arrive at reliable conclusions from data obtained by a diversity of methods. Five physicians recently examined one of our high school girls for eligibility in athletics. All five saw the girl on the same day and within the hour's time. The first refused an O.K. for strenuous athletics. The next two approved of her physical condition. She should have stopped there, as the fourth said she was in a terrible way. The fifth must have been warned—he told her to have her teeth fixed. Each man had given his honest opinion. That is how the data for Bulletin 226 were obtained—on the honest opinion of private practitioners of dentistry. Until we can publish a report based on data obtained through standardized examinations on standardized charts, we are trying to subtract pears from apples.

We note that of the four states from which came more than two thirds of the data used, New Jersey included pits and fissures in the caries rate; whereas Indiana, Minnesota and Tennessee did not. (Page 3, Bulletin 226.) For years, Dr. Hyatt and I attempted to correlate data on dental caries from various sources, only to find ourselves checked by the same old story—the lack of uniformity in examination technic. You have a good, workable, reliable chart, a fitting memorial to Dr. Messner, but, before this work is done again, let us standardize our examination technic.

It is hardly fair to any community to compare its findings, made with a sharp explorer, mouth mirror and good light, with the results obtained elsewhere with a tongue depressor or even with the average explorer found in our offices after it has been used to pry out an old amalgam filling. It would be so easy to use one of the methods outlined by Alfred Walker, and then state specifically that Walker Examination No. 1 was used, or No. 2 or No. 3. Then all the No. 1 type examinations would be comparable, and, in turn, the No. 2's could be correlated.

COUNCIL ON DENTAL THERAPEUTICS

RELATIVE ABRASIVE PROPERTIES OF THE MORE COMMONLY USED DENTIFRICE ABRASIVES

By HAROLD N. WRIGHT, M.S., Ph.D., and ELBERT L. FENSKE, D.D.S.,
Minneapolis, Minn.

The Council has repeatedly pointed out in its consideration of dentifrices the need for more information on the physical properties of insoluble materials entering into the manufacture of dentifrices and of the finished dentifrice. It was reported long ago that certain dentifrices were unduly abrasive and thus damaged the teeth. Other views were that different teeth might react differently to the same dentifrice. This belief was based on the great differences in "hardness" of the cementum, the enamel and the dentin. The paper by Drs. Wright and Fenske attempts to define more carefully than has been done in the past the abrasive properties of dentifrice materials and to present a possible interpretation of their significance. The Council authorized publication of this paper as one in its series on pharmacology and therapeutics, with appreciation and thanks to the authors.

SAMUEL M. GORDON, *Secretary.*

MOST of the dentifrices in common use at the present time contain at least one ingredient possessing abrasive properties. Of the eighteen dentifrices which were accepted for inclusion in Accepted Dental Remedies 1935,[1] all but one contain one or more abrasives.

Relatively little work has as yet been done to determine the extent of the abrasion of the various tooth structures which may result from daily use over a period of years of dentifrices containing abrasives. Progress has undoubtedly been made in the last few years in eliminating some of the more objectionable abrasive agents from widely used dentifrices, but, as stated in a recent report of the Council on Dental Therapeutics,[2] "no attempt, it appears, has ever been made to analyze the course of a dentifrice when used with a toothbrush, and some may be harmful because of a mechanical abrasive action."

A dentifrice may be considered to come in contact with the gums and the teeth. No convincing evidence has ever been secured that dentifrices, either frankly medicated or unmedicated, are useful in preventing or overcoming dental disease of either the hard or the soft tissues. Massage with or without the toothbrush is held by many conservative periodontists to be a form of preventive or curative therapy in certain diseases of the gums, by virtue of the stimulation that it affords, primarily to congested capillaries near the gingival margins. Periodontists, as a rule, are outspoken in their condemnation of any statements that dentifrices can do more than the brush alone, properly used, could do. The only function of a dentifrice, then, is as an aid to the toothbrush in cleansing the surfaces of

(From the Department of Pharmacology, University of Minnesota Medical School. Completion of this project was made possible by workers supplied on Project 6094-4214, Minnesota Works Progress Administration. Sponsor: University of Minnesota.)

the teeth. Neither toothbrush nor dentifrice, as commonly used, has been shown to be effective in the interproximal spaces or on the lingual aspects of the teeth.

It would appear, therefore, that the possible harmful effects of dentifrices from excessive abrasive action constitute a much more important and necessary field of investigation than their doubtful therapeutic properties.

The fact that dentifrices may cause harmful abrasion of the teeth was probably first pointed out by Miller[3] in 1907.

It is not uncommon in dental practice to see cases of mechanical abrasion at the gingival margin presumably caused by the use of dentifrices. Ray and Chaden[4] reported the presence of material in certain dentifrices which was capable of producing scratches on hardened tool steel.

HISTORICAL

Miller, more than thirty years ago, carried out one of the most complete studies on abrasives that has thus far been made. As a result of his investigations, he stated that "in two hours of the same kind of brushing as is used in the mouth, it is possible with some of the most popular dentifrices on the market to cut the tooth half way through, exposing the pulp chamber."

Miller also determined the relative hardness of dentin and enamel, stating that "the dentine wears away approximately fifteen to twenty times as fast as the enamel." He also pointed out that gold (foil), although considerably softer than dentin, is not so brittle, and wears away less rapidly, and that consequently "we shall find the gold standing higher than that of the dentine and slightly lower than that of the enamel."

Van der Merwe[5] was the first investigator to mention the cemento-enamel junction as more susceptible to abrasion than any other exposed portion of the tooth. In his studies, he employed a machine that gave the equivalent of ten years of brushing on freshly extracted teeth (cuspids and bicuspids), and he frequently found that the pulp chambers of these teeth were exposed at the conclusion of the test.

Bodecker[6] stated that the abrasive ingredients may be harmful to the tooth surfaces, if these surfaces are roughened by the action of the abrasive or abrasives incorporated in the dentifrices. He further pointed out that dentifrices are primarily used to remove unesthetic deposits from the teeth. He deals with two types of possibly injurious ingredients that quickly remove deposits and temporarily "whiten" the teeth; namely, "grit" (abrasives) and acids.

Dobbs[7] studied the surface-resisting property of enamel against the action of 0.75 per cent lactic acid in removing a protective covering that he designated a dental plaque. He stated that this plaque is not found on unerupted teeth; and he asserted that it retards the action of abrasives on teeth, and that if the dentifrice contains an acid which removes the plaque, the abrasive may then cause injury to the tooth structure.

Ray and Chaden studied the abrasive properties of a large group of commercial dentifrices as purchased on the open market. They grouped the dentifrices tested according to the extent to which they produced (1) scratches on silver blocks and (2) loss in weight of antimony blocks. Of the fifteen dentifrices which they tested, they rated three as slightly abrasive, seven as moderately abrasive and five as markedly abrasive.

No studies appear to have been made of the actual extent of the abrasive action of the individual abrasive substances in pure form in contact with human teeth. In the present study, we have endeavored to obtain such information in order to have a better understanding as to how much actual wearing away of the tooth structures may result from the presence of any particular abrasive in a dentifrice.

EXPERIMENTAL

The determinations of the abrasiveness of the various substances were made on

freshly extracted human teeth from all age groups of both sexes. Immediately after extraction, all teeth were placed in a 10 per cent formalin solution. All tests were made on noncarious tooth structures.

Miller, Van der Merwe and others employed human teeth in abrasive studies, but did not make quantitative measurements of the extent of the abrasion. Other investigators, notably Ray and Chaden, have employed quantitative methods, but used metal blocks for their quantitative measurements and studied only complete dentifrice preparations, some of which contained three or four different abrasives.

Miller, as early as 1907, apparently realized that the wearing of a metal surface by an abrasive does not parallel the wear of the actual tooth structure, when he stated that, in the case of gold foil fillings, "we shall find the gold standing higher than that of the dentine and slightly lower than that of the enamel."

Ralph L. Dowdell[8] has pointed out that when abrasive substances are brought in contact with a metal surface under pressure, there is a definite tendency for the surface of the metal to "flow" and still remain an integral part of the metal block, rather than to be "excised" by the action of the abrasive. Neither the extent of surface scratches nor the loss in weight of metal blocks would therefore be a direct measure of the cutting power of an abrasive.

In our experiments, tests were made with each abrasive, using an antimony block of Brinell hardness 64, in order to furnish a means of comparison of the abrasion on the metal block with the abrasion on the various structures of the teeth.

The apparatus used was that previously described by Ray and Chaden. The teeth were mounted on the arm of the apparatus and cut in the manner shown in Figure 1. These methods of cutting and mounting the teeth were used in order to bring the proper portion of the tooth structure in contact with the abrasive and in such a way that the axis of the structure was perpendicular to the plane of the revolving disk carrying the abrasive.

Each tooth was measured before and after the test with a micrometer graduated to 0.01 mm. All readings of the micrometer were made in triplicate. A constant load of 100 gm. was maintained on the tooth. A load of this magnitude was also used by Ray and Chaden; and we found it to be the most satisfactory through trial and error, lighter loads causing uneven "riding" of the tooth and heavier loads causing the tooth to cut into the wax disk carrying the abrasive. The wax disk consisted of a mixture of paraffin and caranauba wax, the proportions of which were varied with the temperature.

By the addition of water, the abrasives were made into a paste of a consistency that gave a satisfactory "flow" and "spreading" on the disk. Water was added from time to time during the course of a test in order to keep the consistency of the abrasive as nearly constant as possible. It was recognized that the presence of large quantities of soap or glycerin in a commercial dentifrice might tend to mask the abrasive properties of the abrasives used in that dentifrice, especially when tested at the consistency used on the testing apparatus. In actual use, the dentifrice in the mouth is rapidly diluted with saliva, so that the abrasive action in the mouth should more nearly approach the conditions that we have established. Furthermore, we wished to study the true abrasive action of these abrasive substances, uncomplicated by the presence of interfering conditions.

Ten thousand revolutions of the disk were used for determination of the wear on the antimony block and enamel; whereas, for the softer structures, namely the dentin and cemento-enamel junction, 5,000 revolutions were used.

Control tests on all three of the tooth structures studied showed that no abrasion was caused by 10,000 revolutions of the

wax disk in the absence of any abrasive. No loss in weight of the antimony block occurred under similar conditions.

The results obtained are shown in the accompanying table. The figures presented represent in each case the average result obtained from the use of from twelve to forty teeth with each abrasive on each tooth structure. The values for the loss in weight of the antimony block represent the mean of at least twelve determinations with each abrasive.

ABRASIVE ACTION OF THE COMMONLY USED DENTIFRICE ABRASIVES ON VARIOUS TOOTH STRUCTURES AND ON AN ANTIMONY BLOCK

Abrasive	Wear in the Three Principal Structures 0.001 Mm.			Average Abrasiveness‡	Loss in Weight of Antimony Block Mg.	Ratio of Abrasiveness‡	
	Enamel	Dentin	Cemento-Enamel Junction			Teeth	Antimony Block
Calcium carbonate, precipitated, U.S.P.	24	335	190	100	3.6	....	....
Prepared chalk	26	831	555	216	9.8	2.16	2.72
Magnesium carbonate	17	313	529	148	3.4	1.48	0.94
Magnesium oxide	15	242	433	121	20.6	1.21	5.72
Dicalcium phosphate, C.P.	23	396	361	134	24.0	1.34	6.66
Dicalcium phosphate, A.D.R.*	11	190	240	76	1.4	0.76	0.39
Tricalcium phosphate, U.S.P.	32	338	646	229	8.9	2.28	2.47
Tricalcium phosphate, technical	420	1660	1450†	1143	80.6	11.43	21.83
Tricalcium phosphate, C.P.	30	280	120	91	6.4	0.91	1.78
Tricalcium phosphate, A.D.R.*	15	73	53	38	1.1	0.37	0.30

*The samples of dicalcium phosphate A.D.R. and tricalcium phosphate A.D.R. were furnished through the courtesy of the Victor Chemical Works, Chicago, Ill.

†On account of the extreme abrasiveness of this sample and the relatively small size of the cemento-enamel junction, this value was obtained by multiplying by 5 the wear after 1000 revolutions.

‡Calcium carbonate = 100.

RESULTS

For the entire group of abrasives studied, with the exception of the technical tricalcium phosphate, the average amount of loss of surface was approximately 0.021 mm. Since the enamel has a thickness varying between 2 and 4 mm. (average about 0.3 mm.), this amount of wear represents an abrasion of not more than 1 per cent of the mean thickness of the enamel. It would appear justifiable, therefore, to draw the conclusion that the abrasives calcium carbonate, prepared chalk, dicalcium phosphate, tricalcium phosphate, magnesium carbonate and magnesium oxide, if used in a sufficiently pure form, will not cause any appreciable injury to sound enamel from their use in dentifrices.

That very injurious and harmful abrasion even of the enamel may occur from the presence in these abrasives of highly abrasive impurities is evidenced by the results obtained with the specimen of technical tricalcium phosphate which in 10,000 revolutions wore away practically the entire enamel of the thickest portion of an unabraded first molar. Too much stress cannot, therefore, be laid on the

necessity for insisting that all abrasives employed in commercial dentifrices be subjected to satisfactory tests of their abrasive properties before being incorporated in a dentifrice preparation. The fact that Ray and Chaden found that at least one third of the most extensively used commercial dentifrices exhibited excessive abrasive properties is an indication that sufficient precautions are not being taken by certain dentifrice manufacturers to employ abrasives in their dentifrices of a satisfactory degree of freedom from highly abrasive impurities.

The mean amount of abrasion caused by 5,000 revolutions in the case of the dentin and cemento-enamel junction is approximately the same, namely, 0.35 mm. In other words, one half the number of revolutions caused from fifteen to twenty times as much wear at the cemento-enamel junction or dentin as was produced on the enamel.

Since a mean abrasion of 0.35 mm. represents a wearing away of approximately 10 per cent of the combined cemento-enamel junction and dentin of the average thickness at the level of the former, it would appear that while the abrasives studied may not cause appreciable injury to sound enamel, they are capable of causing considerable abrasion of the softer tooth structures where these are exposed. The presence of abrasives in dentifrices can, therefore, be considered relatively harmless only when used by persons who do not have any of the softer structures of the teeth exposed.

Since gum recession, chiefly from caries and periodontoclasia, is so frequently seen, the injurious effects of abrasives on the softer structures of the teeth may be much greater than is generally realized by the average dental practitioner.

In determining the relative abrasiveness of the substances tested, precipitated calcium carbonate was chosen as the basis for comparison, since it is the most frequently used dentifrice abrasive, being employed in 55 per cent of the dentifrices accepted by A.D.R. 1935, and since it agrees closely in mean values for the abrasive properties with the entire group. The average abrasiveness was calculated from the accompanying formula, which gives a measure of the abrasiveness at each of the three structures tested as compared with that of precipitated calcium carbonate.

In calculating the average abrasiveness in this way, it may be seen that two of the abrasives tested, prepared chalk and tricalcium phosphate, U.S.P., are more than twice as abrasive as precipitated calcium carbonate, and that one of the abrasives, a brand of tricalcium phosphate, A.D.R., is less than two-fifths as abrasive as precipitated calcium carbonate. It may also be seen that the most abrasive of the pure abrasives is more than six times as abrasive as the least abrasive material tested.

$$\text{Average abrasiveness} = \tfrac{1}{3}\left\{\frac{E \times 100}{24} + \frac{D \times 100}{335} + \frac{C.E.J. \times 100}{190}\right\}$$

where E = measurement of wear on enamel in 0.001 mm.
D = measurement of wear on dentin in 0.001 mm.
C.E.J. = measurement of wear on cemento-enamel junction in 0.001 mm.

The dangers attending the presence of harsh impurities in abrasives is again brought out by the values for the technical tricalcium phosphate, which was more than eleven times as abrasive as precipitated calcium carbonate and more than thirty times as abrasive as the least abrasive agent tested.

Comparing the relative abrasiveness to that of precipitated calcium carbonate as determined (a) on the teeth and (b) by the loss in weight of an antimony block, we find that the ratios vary by ten times, the highest being for dicalcium phosphate, C.P., which has a ratio of 5 (6.66 : 1.34), and the lowest for dicalcium phos-

phate (brand) A.D.R., which has a ratio of 0.5 (0.39 : 0.76). In other words, when tested as to the actual wearing away of the tooth structures, one sample of dicalcium phosphate is found to be 34 per cent more abrasive and a second sample 24 per cent less abrasive than precipitated calcium carbonate; whereas, if the same tests are made on an antimony block, the first sample is apparently 500 per cent as abrasive and the second sample 50 per cent as abrasive as precipitated calcium carbonate. For the entire group, the abrasiveness on the antimony block is twice as great as that on tooth structures.

One possible explanation of this would be that the tendency of the metal to "flow," particularly with the less abrasive substances, has caused the value for loss in weight with calcium carbonate to be too low. That this is probably the case is further seen in the fact that two of the three abrasives, which when tested on teeth are less abrasive than calcium carbonate, give even lower values for abrasiveness when tested on the antimony block.

If, then, we accept the interpretation of the mean value for the ratio

$$\frac{\text{Abrasiveness according to antimony block}}{\text{Abrasiveness according to teeth}} = 2$$

as being due to the loss in weight of the antimony block produced by the action of precipitated calcium carbonate and as being therefore only one half what it should be, owing to "flow," the fact is even more evident that the tendency of the metal to "flow" instead of "abrade" has caused the wear on the antimony block with tricalcium and dicalcium phosphates A.D.R. to be only 25 per cent and 40 per cent respectively of their true values. It therefore appears to be justifiable to conclude that the determination of the abrasiveness of dentifrice abrasives by the loss in weight of an antimony block is not justified because, owing to the tendency of the metal surface to "flow" rather than "abrade," the abrasive properties of a majority of the abrasive substances appear less than is actually the case when the abrasives are in contact with actual tooth structures.

SUMMARY AND CONCLUSIONS

1. A study has been made of the extent of abrasion on the enamel, dentin and cemento-enamel junction of freshly extracted noncarious teeth from the action of the abrasive agents most commonly employed in dentifrice preparations. Water only was used as the vehicle, as such ingredients as glycerin and soap may possibly mask the abrasive effect.

2. The loss of enamel after 10,000 revolutions ranged between 0.011 and 0.032 mm., representing not more than about 1 per cent of the average thickness of the enamel. A specimen of technical tricalcium phosphate caused a loss of 0.420 mm.; i.e., a loss of from 10 to 20 per cent of the average thickness of the enamel. It is concluded that the abrasives investigated, if in pure form, cause no appreciable injury to noncarious enamel. The presence of highly abrasive impurities in these abrasives may, however, cause marked wearing away even of the enamel.

3. The loss of dentin after 5,000 revolutions ranged between 0.073 and 0.831 mm. (mean, 0.350 mm.).

4. The loss of surface at the cemento-enamel junction after 5,000 revolutions ranged between 0.053 and 0.646 mm. (mean, approximately 0.350 mm.).

5. The extent of the abrasion occurring at the dentin and cemento-enamel junction is sufficient to indicate that the prolonged use of any of the substances studied may appreciably wear away either of these structures if they are exposed.

6. Using precipitated calcium carbonate as the standard of abrasive action on all of the three structures studied, we find that, of the preparations tested, tricalcium phosphate, C.P. (91 per cent), tricalcium phosphate (brand), A.D.R. (38 per cent) and dicalcium phosphate (brand), A.D.R. (76 per cent) were less abrasive than precipitated calcium carbonate; whereas

prepared chalk (216 per cent), magnesium carbonate (148 per cent), magnesium oxide (121 per cent), dicalcium phosphate, C.P. (134 per cent) and tricalcium phosphate, U.S.P. (229 per cent) were more abrasive. A specimen of technical tricalcium phosphate containing harsh abrasive impurities was 1,143 per cent as abrasive as precipitated calcium carbonate.

7. The comparison of the abrasion occurring on the actual tooth structures with the loss in weight of an antimony block shows that the tendency of the metal surface to "flow" rather than abrade causes all but the most abrasive agents to appear less abrasive than they actually are on the tooth structures. This flow factor was greatest with the least abrasive agent, the loss in weight of the metal block being only one fourth of what might be expected on the basis of the comparative wear on the tooth structures. It is concluded, therefore, that tests of the abrasive properties of dentifrice abrasives, if made on antimony or other metal blocks, do not give a true measure of the comparative abrasive action of these abrasives on tooth structures.

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ZINC OXIDE IMPRESSION PASTES AND SURGICAL PACKING

The following informative statement of the Council has been authorized for publication.

Samuel M. Gordon, *Secretary.*

THE Council has issued no report on Kelly's Impression Paste. It has referred dentists to an article by Dr. R. A. Ross in The Journal for November 1934, page 2029. According to this article, which was prepared on the suggestion of the A.D.A. Bureau of Chemistry, a zinc oxide impression paste may be made by following a recipe which now appears in Accepted Dental Remedies.

Powder:	Zinc oxide	85 parts by weight
	Powdered rosin	15 parts by weight
Liquid:	Oil of cloves	60 parts by weight
	Canada balsam	35 parts by weight
	Balsam of Peru	5 parts by weight

Accepted Dental Remedies also points out, under zinc oxide, that particular care must be used in intimately mixing together the solid ingredients. This is best done by passing the material through as fine a sieve as possible. The results secured with this paste appear to be variable. In the hands of some, it works with entire satisfaction; in the hands of others, it appears not to work satisfactorily. The European literature indicates that the recipe is satisfactory. Dentists who have had unsatisfactory results with the product were advised to use a little cement liquid to accelerate the hardening or to add a small amount of zinc chloride.

Patent No. 2,077,418, issued April 20, 1937, to Ernest Byron Kelly, of Chicago, Ill., is for a dental impression paste which, in some respects, is similar to the recipe of R. A. Ross and appearing in Accepted

Dental Remedies. This patented dental paste is also advocated for use in sockets after extraction and in pyorrhea pockets, and the statement is made that the paste "permits bodies antagonistic to pathogenic organisms to become active."

According to the patent, the proportions of the ingredients of the powder, namely, zinc oxide, rosin and the hardener, which is anhydrous magnesium chloride, may be varied through a wide range. The most satisfactory ranges are said to be:

	Per cent by weight
Zinc oxide	50 to 95
Rosin	5 to 50
Hardener ($MgCl_2$)	0.1 to 10

However, the preferred formula, according to the patent, for the solid portion, is as follows:

	Per cent
Zinc oxide	80
Rosin	19
Magnesium chloride	1

The following statements concerning the preparation and use, as they appear in the patent, are of interest:

In making up the solid formula, the magnesium chloride is preferably mixed with 4 parts of zinc oxide before addition to the balance of the ingredients. Likewise the rosin is finely ground and preferably mixed with an equal part of zinc oxide. . . . The balance of the zinc oxide is then added to the mixture of magnesium chloride and zinc oxide and the rosin and zinc oxide mixture is mixed thoroughly to obtain a uniform distribution of the magnesium chloride throughout the powdered material. The mixing must be very carefully performed to obtain the necessary uniformity of distribution of the magnesium chloride in view of its relatively small percentage of the whole. . . .

I prefer to do all of the operations of preparing and mixing my product at as low a humidity and temperature as possible, and also to have the containers cold and dry. I also prefer to have the containers in which the prepared product is stored be air and water tight.

The preferred formula of the oil portion is as follows:

	Parts by weight
Oil of cloves or eugenol	100
Gum rosin	30
Olive oil	30
Linseed oil	10
Light mineral oil	10

The following statements concerning the oil portion are of interest:

The above proportions are not critical, but can be varied through a wide range. As previously stated, both the olive oil and linseed oil may be omitted or some other non-drying, or semi-drying oil substituted. Likewise, the gum rosin may be omitted from the oil formula and correspondingly increased in the solid formula. However, I find that a superior product is produced if part of the rosin is dissolved in oil.

The following appears concerning its use:

When the preparation of my invention is to be used, a definite quantity of the solid formula is measured out, as, for instance, a half-teaspoonful (approximately 1 gram), and placed on a glass slab or the like, and then a definite quantity of the oil formula, such as 10 drops (approximately 0.3 gram), is measured out onto the slab and the oil and powder thoroughly mixed to form a paste. No water is added, nor should any moisture or water be present on the slab during the mixing process. After the paste has been prepared, it may be allowed to stand for upwards of an hour or longer without setting. In case the humidity is very high, the setting may be retarded somewhat under these conditions by using a heated mixing slab.

It may be interesting to point out that such recipes, which have been sold to the profession under fancy names (Wondrpak, Dentopak, Surgopak) and at exorbitant prices, basically are not new. Their newness consists essentially in the energy with which they have been pushed. As far back as 1898, an oxide of zinc and eugenol cement composed of 10 parts of zinc oxide (87 per cent), and 1.5 parts (13 per cent) of pulverized yellow rosin, mixed with eugenol, was used as a cement for temporary restorations (Black's Operative Dentistry, Vol. 3, Ed. 7, p. 233).

The use of vegetable or mineral oils to retard the setting time is illustrated in a number of other non-proprietary formulas available. For surgical work, one of the simplest is: zinc oxide and resin, equal parts, mixed with a liquid composed of eugenol and liquid petrolatum or olive oil, equal parts (Accepted Dental Remedies, 1937, page 136).

Thus one sees that there is considerable latitude permitted in the formulas of these powders for satisfactory performance. Experience with a particular mixture is possibly necessary for satisfactory work.

PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

Sinus Opening—When a sinus opening is closed, our responsibility in the oral cavity is finished. Treatment of chronic or acute sinusitis is a specialty of the medical profession.—*A. M. Stinson, Stewartstown, Pa.*

Canker Sores—When a patient comes in with a canker sore or multiple canker sores and wishes to be excused from his appointment, apply 50 per cent trichloracetic acid to them, and you may proceed without fear of annoying the patient. The canker sores will usually heal.—*J. R. Gavin, Olean, N. Y.*

Paregoric in Child Extractions—In extracting abscessed teeth for children, a dose of paregoric, dosage according to age, will work wonders in helping relieve pain and shock and relaxing the child to the extent that better anesthesia can be obtained.—*Claude A. Moore, Lexington, Miss.*

Hydrocolloid Impression Material—In the formula previously given for hydrocolloid impression material (J.A.D.A., 24:833, May 1937), thymol iodide can be substituted for the mercurochrome and most or all of the chalk. Thymol iodide will prevent the growth of microorganisms on agar jelly, and, being a light insoluble power, acts very well as a filler.—*Alfred T. King, Chicago, Ill.*

Impression Taking—Since no standardized method of impression taking is suitable for every mouth, perfection in impressions has not yet been reached or else there would not be so many "floating lowers." As each mouth presents problems of its own, a combination of the well-known systems with one of your own may be the best. As H. E. Williams says, "The unorthodox is better than the orthodox when it is more satisfactory."—*A. M. Stinson, Stewartstown, Pa.*

Fractured Anterior Permanent Teeth—These teeth with traumatically exposed pulps are so easily saved, to develop fully and remain vital, it seems a crime that so many dentists think only of extraction and have an incredulous expression when partial pulpectomy is suggested. However, it has been our practice, as with many of the older dentists since the eighties, and is now general practice in the clinics of most of the American Dental Colleges, to perform partial pulpectomy at the cervix. A period of many years proves the pulps to be vital. Den-

tists not familiar with this old and tried operation should learn of its value and cease disfiguring their patients.—*W. Clyde Davis, Lincoln, Nebr.*

Cast Surveyor—A very inexpensive but completely adequate cast surveyor can be made by cutting the ring from an ordinary chemist's flask stand, and, at the same spot, parallel to the upright of the stand, soldering a tin tube about four inches long, molded to fit a Morse scaler handle, into which has been fitted a piece of pencil lead. The base of the cast to be surveyed is forced into a mold of "plasticene" on a small tray which rests on the floor of the stand. The pencil is then adjusted to the desired height by means of the thumb screw, and the tray containing the cast is moved around until the tooth to be surveyed is in approximation with the lead in the scaler handle.—*Bernard S. Chaikin, Boston, Mass.*

The Small Filling—Patients are seldom cognizant of the fact that the smaller the filling, the greater its value to them. Smallest means greater intrinsic tooth strength and prolonged durability. The profit derived from small fillings may help to offset the loss often suffered in larger ones. The amalgam in small cavities shrinks less. The silicates have less surface to wear and wash. The patient's basis for fees is often contingent on cavity size. The smaller, the lower. Explanation should convince patients that with decay removal, all cavities become larger, and the more thorough the preparation, the larger the cavity becomes. No cavity should be judged by size alone. Why should something better cost less simply because it is small? In the determining of values, size should be the accepted standard.—*Herbert Ely Williams, Red Bank, N. J.*

Soap for the Dentist's Hands—A dentist's hands, because of frequent washing, require a mild soap. Many so-called castile soaps, and in particular most of the commercial liquid soaps, are at once expensive and harsh. Castile soap U.S.P. is a very mild and effective soap and permits convenient conversion to a liquid form for use in a liquid soap dispenser. These devices are inexpensive and will eliminate the unsightly and unsanitary bar of soap and dirty soap dish. A very fine liquid soap may be easily prepared by dissolving with the aid of heat an ordinary size bar of Castile soap U.S.P. in about three pints of water. Shaving the soap into thin flakes will hasten its solution. The addition of about one teaspoonful of olive oil will help to soften the skin, and a few drops of perfume, oil of peppermint, anise or bitter almond (wild cherry) will impart a pleasant odor to the hands.—*C. Frank Tuma, Cleveland, Ohio.*

A Simple, Permanent and Inexpensive Method of Mounting Films—A sheet of ordinary cellophane, such as can be bought in sheets at the ten cent store, and large enough to accommodate the films to be mounted, with allowance for a margin, is completely and smoothly covered with paste. The films are placed on the paste-covered surface together with a slip of paper containing the records. Another sheet of about the same size is covered with the paste and laid over the first sheet, the two paste-covered sides being in contact. With an ordinary squeegee roller such as is used in mounting photographs, the two sheets are forced together with the films between. The films are there to stay. They cannot slip out and the records are permanently attached to them. The surplus cellophane around the edges can be trimmed away with scissors. The paste which best answers the purpose, as far as I know, is "moisture proof adhesive No. 862," manufactured by the Union Paste Company of Medford, Mass. It is transparent and will not interfere with transillumination provided it is smoothly spread.—*Fred R. Adams, New York City.*

INCIDENTS OF PRACTICE

Tooth in the Sinus?

By Louis Ringol, D.D.S., Louisville, Ky.

A man, aged twenty-six, consulted me in regard to a cavity in the upper right second bicuspid tooth. I immediately noticed the absence of the cuspid, and questioning the patient as to his previous dental history, I found that he had no knowledge as to the whereabouts of the tooth. I immediately advised a roentgenogram and found the condition shown in the accompanying illustration.

I am not absolutely certain as to the lateral position of this tooth, but I consulted a medical confrère of this city, and he is of the same opinion that I am; that is, that the tooth is in the sinus, and that there is erosion

of the crown. We have decided not to disturb this tooth, since the patient has no complaint as to sinus symptoms, headaches, etc. I have advised him to have this tooth roentgenographed at least once a year.

1000 Brown Building.

Supernumerary Lower Molar Associated with a Mild Case of Osteomyelitis

By Arthur N. Kracht,* D.D.S., Fort Brady, Mich.

J. B., a white man, aged nineteen, an enrollee on duty with the Civilian Conservation Corps, was admitted to Station Hospital, Fort Brady, Mich., January 25, 1937, with a tentative diagnosis of osteomyelitis of the right mandible.

History.—December 30, 1936, the right lower second and third molars were extracted by a civilian dentist. One tooth caused difficulty in extraction, but the patient failed to recall which one. Considerable pain was experienced, but this subsided ten days after the extraction. January 20, the jaw again became very painful and swollen. Treatment at the camp dispensary consisted of sedatives and hot fomentations.

Examination.—There were large open sockets of two previously extracted teeth, considerable accumulation of débris and

some discharge. Externally, a large area of swelling was present at the angle of the jaw.

Pain was intermittent and quite severe at times. In chewing, pain would start in the area of the left lower first molar and extend throughout the mandible, becoming more severe in the area of the sockets of the right lower second and third molars.

Temperature varied from 99 to 100° F., becoming normal January 31.

With the use of hot irrigations and hot magnesium sulfate packs, the swelling subsided considerably.

After failure of four attempts to make roentgenograms with small dental films, due to retching and emesis, an 8 by 10 lateral pic-

*First lieutenant, Dental Corps.

ture of the right mandible was taken. This revealed a supernumerary molar in the ramus of the mandible, impacted, in an inverted position and distally to and above the socket of the right lower third molar. In order to get the complete outline of the tooth, the film was taken at an angle which caused apparent distortion of the tooth. Actually, the occlusal surface of the molar was above the occlusal line and not below as shown in the film.

When the swelling began to subside, there was a tender area at the lower border of the mandible. There was no soreness distally to the sockets and no tenderness in the retromolar area. However, the paroxysms of pain continued to be as severe and as regular as they had been previously.

Operation.—February 2, thirty minutes after the administration of a quarter grain of morphine sulfate, the tooth was extracted, under mandibular nerve block anesthesia. The extraction consisted simply of removing enough bony tissue to expose the crown of the tooth. With the use of a bibeveled drill, a notch was cut just above the cementoenamel junction. In this notch, an elevator was inserted, and the tooth was manipulated downward and forward into the open socket of the third molar. An external drain was then placed to the area of the second molar socket. There was no pus present at this time.

Outcome.—The following day, the patient was quite toxic with a temperature of 101° F. There was a mild trismus. The extreme pain had subsided. Three days later, the patient was recovering. Until February 16, there was a discharge from the external drain and also from the socket. Two small spicules of bone were removed February 18.

The sockets were not curetted, but were carefully explored. No rough edges or spicules of bone were found, and further interference was deemed inadvisable.

Oral hygiene was excellent, but the patient could not keep the sockets clean.

Postoperative treatment consisted of irrigation with warm dilute potassium permanganate solutions after every meal.

Improvement was very slow until March 10, after which the alveolus gradually grew smaller. The patient was discharged March 22.

Comment.—There was probably an injury to the pulp tissue of the supernumerary molar at the time the lower third molar was extracted, which caused the severe pain.

Station Hospital.

Foot Care for the Dentist

By Joseph Lelyveld,* Rockland, Mass.

The dentist, more than any other professional person, should realize his dependence on his feet. No matter how strong of determination, he is doomed to slow up at the wrong time unless his feet are comfortable and efficient. Foot health is easily achieved but, as in all hygiene, common sense is the foundation and fundamental in foot care.

Here are eight rules for foot health:

1. Select shoes that will help, not handicap, the normal action of the foot. Shoes to be worn at the chair should be generous in width and length; they should be made of light weight kid leather, with flexible soles, to bend easily at the ball of the foot.

2. Select socks of ample size, too, not snug fitting, but at least one-half inch longer than the foot. If you wear woolen socks, wear cotton socks inside them to avoid irritation and excessive sweating.

3. Keep the feet parallel in standing. Toeing in or out weakens the ankles and arches.

4. If your feet tire easily, massage them at night with lanolin and dust boric acid powder over the feet every morning.

5. Bathe the feet frequently in water of comfortable temperature, neither too hot nor too cold. A handful of sea salt to each quart of water is refreshing and stimulating.

6. Do not cut corns or callouses yourself. This should be done only by a chiropodist or podiatrist. If your corns or callouses need protection, use a thin corn plaster that will stay in place.

7. Cut the toe nails straight across, not round at the corners or too short.

*Director of the National Foot Health Council.

8. When you rest, elevate the feet to a level with the body. To relieve your feet, change to a fresh pair of shoes and socks in the middle of the day.

These rules have been followed successfully by professional men who are on their feet continuously, and they have helped to keep the feet in good condition.

A Mouthwash

By Fred R. Adams, D.D.S., New York City.

The Council on Dental Therapeutics, under the heading "Mouthwashes," in "Accepted Dental Remedies" summarizes its findings as follows: "The only legitimate use of a 'mouthwash' to the general public is as an adjunct to the toilet of the mouth, to make the mouth temporarily taste pleasant." The Council also remarks, regarding their use in the dental office, that it is limited to "their employment as a pleasant tasting solution for gargling and spraying after operations."

Most patients appreciate an agreeably flavored rinse because it does make the mouth feel and taste better. It is more pleasant for patients if the spray bottles contain such a preparation rather than plain water or saline solution. There is no reason that we should place ourselves under obligation to the mouthwash manufacturers by accepting the samples which they so generously hand out; neither need we increase their profits by buying their products. It is possible to make a mouthwash which is just as efficient as any and which can be flavored to suit each individual taste at a cost which is largely determined by the meter charge for the water which is used.

About a teacupful of ordinary hydrated lime, which can be purchased at a paint store at a cost of approximately 5 cents a pound, is placed in a quart milk bottle, or a proportionate quantity in a larger bottle, and the bottle filled with water. This is allowed to stand for a few hours and then the liquid portion decanted into a dispensing bottle. The original bottle is refilled with water. No more lime is to be added as we have enough to last for several years. Water is added every time we take out any of the lime water. Occasionally the lime in the bottle is stirred. If it is to be used in spray bottles, it is filtered through absorbent cotton or filtering paper; but, for a gargle, this is not necessary.

To the decanted lime water is added a few drops of one of the essential oils, such as wintergreen, cinnamon, peppermint, spearmint, cloves or any other or any combination you wish. We keep three or four spray bottles filled with different flavored solutions and children become quite interested in deciding which they like best. The amount of oil used for flavoring may be determined by our taste. The flavor of any proprietary preparation can be duplicated if desired. The expense of making this mouthwash will be but a few cents a barrel instead of a few dollars a gallon. A great many of our patients make their own mouthwash at home, and they are pleased because they do not feel that they need to be economical when they use it.

55 West 42nd Street.

CURRENT LITERATURE

Chemical Composition of Teeth

Chemical Analysis *vs.* Spectrographic Analysis

By Frances Lowater and Margaret Mary Murray

The samples analyzed were: "Human enamel, non-carious, good structure, London; human dentine, non-carious, London; human enamel, 'mottled,' Maldon; human dentine, Maldon; dog dentine, London; rat enamel, control; rat enamel, NaF in diet." A quartz spectrograph permitted study of the carbon arc spectrum, wave lengths 2100-6200 A°. In addition to the major constituents known in dental tissues, the following were found: sodium, silver, lead, strontium, barium, chromium, tin, zinc, manganese, titanium, nickel, vanadium, aluminum, silicon, boron, copper and iron. Potassium was not found generally. Fluorine was not found in dog or rat teeth; traces occurred in human "mottled" enamel and in teeth of fluoride-fed rats. The iron content was lower in fluoride-fed rats' enamel and dentin. Rough quantitative estimates were made.—*Biochem. J.*, 31:837, 1937.

Harold C. Hodge.

Dermoid Cysts of the Head and Neck

By Gordon B. New and John B. Erich

From 1910 to 1935, inclusive, 1,495 patients with dermoid cysts were examined at the Mayo Clinic. Of the total number of cases, including cysts of the brain, meninges, spinal cord, chest, back, abdomen, ovaries, testicles and extremities, 103, or 6.9 per cent, occurred in the head and neck. Of the 103 dermoid cysts of the head and neck, 49.5 per cent occurred about the eyes and orbits, originating along the naso-optic groove; 12.6 per cent about the nose, resulting from intrusion of the frontonasal plate between the embryonic nasal dermis and mucosa; 23.3 per cent about the floor of the mouth and in the submental and submaxillary region, originating from the upper branchial arches; and 14.6 per cent, formed a miscellaneous group, most of which occur in the midline and develop during closing at the midventral and middorsal lines of the body. Dermoids in the floor of the mouth or in the submental and submaxillary regions must be distinguished from ranulas, cystic hygromas, cysts of the thyroglossal duct, chronic suppurative infections of the submaxillary salivary gland, branchial cysts, lipomas and neurofibromas. The one notable feature which distinguishes a dermoid cyst in these regions from the conditions noted is its "putty-like" or "doughy" feeling on palpation.—*Surg., Gynec. & Obst.*, 65:48, July 1937.

J. Frank Hall.

Report of Anesthetic Deaths

By A. K. Lotz

The author reports all fatalities due to general anesthesia out of 32,883 administrations. He personally administered 15,000 of the total amount. Seventeen fatalities occurred during or at the time the anesthetic was given, which shows death was hastened. The case histories indicate that only five could be attributed to the anesthetic. Some of the deaths could have been avoided had the operation been postponed until the patient was in better physical condition. Only four necropsies were made.—*Cur. Res. Anesth. & Analg.*, 16:70, March-April 1937.

J. Frank Hall.

Ear Symptoms Incidental to Sudden Altitude Changes, and Factor of Overclosure of the Mandible

By G. E. Willhelmy

Costen's study of functional deafness and overclosure of the mandible has given proof of the value of dentistry in these disorders. Aviation has presented the additional problem of sudden changes of atmospheric pressure. Clinical symptoms of temporomandibular disturbance reflected in the ears are: impaired hearing, "stuffy" sensation, tinnitus, dull pain and dizziness, relieved by inflation of the eustachian tubes. In flyers, inability to adjust the ears to rapid changes in altitude is the most important symptom. It seems quite clear that "flying deafness" is the result of overcompression of the eustachian tubes. Under certain conditions, this uneven pres-

sure in the ear may produce vertigo; which probably explains many crashes of unknown cause. Six mouth conditions should cause suspicion of temporomandibular disease: (1) the presence of badly fitting dentures, permitting a closed bite, (2) absence of molar teeth, (3) wide overclosure of the natural teeth, (4) the presence of teeth which are short gingivo-occlusally, (5) absence of the curve of Spee and (6) improper occlusion from faulty posterior bridgework. Four case histories are cited to emphasize the occupational hazard in flyers.—*J. Aviation Med.* 7:177, December 1936.

HAMILTON ROBINSON.

Case of Trigeminal Neuralgia with Osteitis of the Wall of the Infra-Orbital Canal

By M. T. BURROWS

TIC DOULOUREUX should not be confused with minor types of neuralgia of the trigeminal nerve associated with inflammation in the nose, teeth or sinus, or arising from tumor pressure. It is a distinct disease. No typical pathologic lesions have been found in the nerve or ganglion. The author's case, that of a forty-seven-year-old woman, was of eight years' duration. The pain always began in the left cheek and radiated up over the lower forehead. An alcoholic injection had been given, with relief for only three months. The maxillary teeth had been "soft and crumbling" and had been removed at sixteen years of age. The mandibular teeth had been extracted at the beginning of the present illness. A piece of oxidized metal surrounded by a large area of soft bone was removed from the maxillary right molar region without relief. Exploration revealed more dead bone extending to the wall of the infra-orbital canal. When this bone was removed, marked improvement was noted. It is pointed out that dead bone, like "dead teeth," may show a normal architecture in the roentgenogram due to a sort of mummification. This dead bone may liberate toxic substances as it slowly autolyzes and should be suspected to exist when foreign bodies, pulpless teeth or root fragments are present. The more common symptoms are evidenced in distant organs by colitis, pelvic distress, circulatory disease, etc.—*Am. J. Surg. 37:* 506, September 1937.

HAMILTON ROBINSON.

Atrophic Glossitis

By I. MCLEAN

IN addition to local conditions usually obvious on examination, a number of general systemic disturbances may be reflected in the tongue. Hyperchlorhydria often results in small painful ulcers in groups on the oral mucous membrane and tongue, accompanied by dyspeptic symptoms. In cases of achlorhydria, in which there is a complete lack of gastric acidity, atrophic glossitis is seen. The papillae of the tongue are atrophied and as a result the dorsum of the tongue is red, smooth and shiny. Blood examination in these cases of atrophic glossitis may show secondary or pernicious anemia. Three persons with atrophic glossitis, patients of the author, showed microcytic or pernicious anemia. It is emphasized that soreness of the tongue may reflect a more severe general systemic disease.—*Austral. J. Den.* 41:263, July 1937.

HAMILTON ROBINSON.

Sulfanilamide (Prontylin)

By P. H. LONG *et al.*

SULFANILAMIDE inhibits the growth of hemolytic streptococci and is possibly bactericidal to these organisms. It proved very effective in B hemolytic streptococcal meningitis, had some effects on pneumonia and may have shown some value in gonococcal infection, but has no effect on the common cold or influenza. Large doses produce symptoms like those of alcoholic intoxication. A few patients suddenly develop a severe hemolytic anemia, but recover after blood transfusion. The commonest toxic symptoms are vomiting, nausea, fever and cyanosis. Acidosis may occur. The antidote is huge quantities of water (5,000 to 6,000 cc. in a few hours). Sulfanilamide is a powerful drug in certain types of infection, but because of its toxicity should not be used carelessly or indiscriminately.—*Clin. Med. & Surg.* 44:352, August 1937.

HAMILTON ROBINSON.

Treatment of Agranulocytosis

DR. BOCK discussed the treatment of agranulocytosis before the Frankfort Medical Society. The three principal therapeutic procedures in this disease are roentgen stimulation (irradiation) of the medullated bones, blood transfusions and administration of

pentnucleotide. Although nucleotide in large doses has heretofore represented the most effective medicament for the production of leukocytes, a blood transfusion exerts the optimal general effect. With the utmost caution in the selection of donors, copious and frequent transfusions should be given. Satisfactory bridging over the most dangerous four initial days, that is, an effective compensation for granulocyte deficiency in the face of threatening sepsis, is, however, not always achieved if normal blood is used for the transfusions. Consequently, blood from myeloid leukemia has been used successfully. One patient, aged forty, who presented a severe agranulocytosis, was out of danger after twelve transfusions of leukemic blood in nineteen days. The patient was very feverish. No granulocytes could be observed for five days, and pneumonia and necrosis of the gums were present. The total value of leukocytes in these twelve transfusions corresponded to that contained in 250 transfusions of normal blood. The transfusions were unaccompanied by any incident, and in the fourth week the leukocyte balance became positive. "The high grade destruction of the myeloid tissue and the regeneration of myelopoiesis toward normal under the influence of leukemic blood could be observed at all stages of the illness both in the hematomyelogram and in the histologic section of the sternal punctate."—Foreign Letters, *J.A.M.A.* **109**: 886, September 11, 1937.

M. K. Hine.

Vitamin A Deficiency

By Harold Jeghers

The author tested 162 students of Boston University School of Medicine on the biophotometer and from this group chose fifty students showing the best "dark adaptation" and fifty showing the poorest. These two groups were then carefully studied and compared. From these studies, the author concludes that vitamin A deficiency is common in adults and varies from a photometrically detectable phase to the complete clinical syndrome. In a group of medical students, 35 per cent had low photometer readings and 12 per cent had clinical manifestations of the deficiency. The chief manifestations, in the order of their frequency, were: night blindness, photophobia, dry skin, dry conjunctivae, blepharitis and follicular hyperkeratosis. The conditions producing the deficiency were analyzed and it was shown that skipping of meals and poor selection of foods were chiefly responsible. After dietary analyses, it was concluded that 4,000 international units of vitamin A daily represent the minimal requirement for a healthy adult. Infections were more numerous and severe among the deficiency group. Further evidence that it is dangerous for the hemeralope to drive an automobile at night was obtained. Photometric evidence of night blindness appeared in six days and subjective evidence in five weeks after the production of a pure vitamin A deficiency in an experimental subject. Night blindness preceded gross epithelial changes.—*J.A.M.A.* **109**:756, September 4, 1937.

M. K. Hine.

Treatment for Subluxation of the Temporomandibular Joint

By Louis W. Schultz

Partial dislocation of the temporomandibular joint is fairly frequent. Congenital weakness of the capsule, malformation of the condyles, straining of the joint during yawning, general anesthesia, positional postures during sleep, etc., are causes of subluxation. Heretofore, the treatment has consisted mainly of rest, although surgical treatment, physical therapy and changing the bite have been employed. The author describes a method of shortening and strengthening the capsule of the joint by injecting sodium psylliate and attaining "fibrogenesis in the capsule of the joint." Animal experiments were made to investigate the effect of the injection of sodium psylliate. The author discusses these and also clinical results in more than thirty clinical cases in which injection therapy was used. Briefly, his technic is as follows: After a complete history is obtained, if injection therapy is indicated, the mouth is opened wide, the needle inserted in the joint cavity and 0.25 to 0.5 cc. of the sodium psylliate deposited inside the cavity. These injections are repeated biweekly or weekly for three to five weeks or until sufficient fibrosis is obtained. The injection is almost painless, but pain usually follows twenty to thirty minutes later. The author concludes that sodium psylliate is a relatively harmless fibrosing agent. The method of treatment outlined can be used by the general

practitioner and produces "results that approach entire satisfaction."—*J.A.M.A.* **109**: 1034, September 25, 1937.

M. K. Hine.

Dentistry and Dyspepsia

By S. Lossius

Of 328 patients with gastric and duodenal ulcer (161), gastritis (fifty) and dyspepsia (117), only 10 per cent had healthy mouths, whereas 171 showed "deplorable" dental conditions. In a group of 328 hospital patients without gastric disturbances, only eighty had "deplorable" mouths. The ulcer and gastritis group had the highest percentage of poor mouths. After discharge, it was found that 21 per cent of orally untreated had to return to hospital; whereas only 10 per cent of those who received dental treatment had further gastric trouble. The value of cooperation between physicians and dentists in treatment of stomach disease is pointed out.—Lancet, **233**: 750, 1937; abstr. *Nord. med. Tidskr.*, 1214, July 31, 1937.

Basil G. Bibby.

Some Possible Factors Concerning the Development of Dental Caries

By Morisaburo Mizuma

The author investigated the solubility of the enamel, the physicochemical properties of the saliva and acid formation in oral cavities which he believes to be "unexplored" channels of research on dental caries. It was found that enamel was not attacked by solutions with pH values above 6.77 even after fifty days at 37° C. Enamel solubility depended on (a) the hydrogen ion concentration, (b) the titratable acidity and (c) the fluidity of solutions. Deciduous enamel was most readily soluble, adolescent enamel less so and that from old teeth least soluble. Enamel from caries-susceptible patients was more soluble than that of the immune. Persons secreting large quantities of saliva of high viscosity, high pH and strong buffering power are less affected with caries than those secreting saliva deficient in these respects. Examination of 1,811 persons showed girls were more susceptible than boys to caries. Mouth washings from caries-susceptible patients produced more acid when incubated with glucose or sucrose than did those from patients with less caries. This relationship was maintained after all the cavities were filled. In girls' mouths a greater amount of acid was produced than in boys.—*J. Biochem.*, **25**:671, 1937.

Basil S. Bibby.

Recurrence in Mixed Tumors of the Soft Palate

By J. E. Rhoads and P. M. Mecray

Recurrence of mixed tumors of the soft palate is extremely rare. Microscopically, the original and the recurrent tumors resemble each other closely. Three theories have been advanced to explain recurrence in these tumors. Sonnenschein believes that they are seedlings caused by rupture of the capsule in removal of the original tumor. Bech is convinced that, in his case, recurrence was due to "remains of the capsule." Erich believes that these tumors arise from two misplaced blastomeres which start growth at different times.—*A. J. Med. Science,* **193**: 389, March 1937.

E. Hampp.

Supporting Palatine Prosthesis Consecutive to the Removal of Benign Tumors of the Palate

By J. N. Roy

The author recommends removal of the tumor after median incision, and two or three sutures in order to allow coaptation, a vulcanite appliance having been previously constructed to fit over the area of the palate, as if the tumor had never existed, and having three or four holes opposite the tumor area to allow for free drainage. The appliance may be removed from time to time for postoperative treatment of the wound.—*Canadian M. A. J.*, **37**:160, August 1937.

E. Hampp.

Benzedrine—A Review of Its Toxic Effects

By I. J. Davies

Benzedrine is a synthetic drug chemically and pharmacologically similar to ephedrine and adrenalin. It produces a general psychologic stimulation and at the present time it may be purchased without a prescription. Continued use of the product is a dangerous procedure because of the resultant acute aplastic anemia. This condition manifests itself by severe headaches, inability to sleep and restlessness, and may cause severe cardiovascular collapse. With the discontinu-

ance of the drug, gradual recovery ensues.—*Brit. M. J.*, September 25, 1937, p. 615.

J. VOLKER.

Coagulation Defect in Hemophilia

By F. J. POHLE and F. H. TAYLOR

ASSUMING that the defect in the coagulation of blood in hemophilia was in the plasma rather than the platelets, the authors isolated a clot-promoting factor which they called "globulin substance" in normal blood plasma. It was found that intramuscular injections of globulin substance in hemophiliacs resulted in a marked reduction in blood coagulation time. Following the initial injection, a refractory phase was established in which subsequent injections of the globulin substance had little or no effect on the coagulation time. The evidence did not indicate a non-coagulable phase following the administration of the plasma derivative.—*J. Clin Investigation*, **16**:741, September 1937.

J. VOLKER.

Black Hairy Tongue

By R. PRICE

SEVEN cases are mentioned. A specimen was discovered at necropsy on a man seventy-one years of age. Death was due to arteriosclerosis. Anterior to the circumvallate papillae were two hairlike tufts one-half inch long. In front of this was a feltlike area 1 inch square. Microscopic examination revealed chronic inflammation of the subepithelium and hypertrophy of the epithelium. The condition was essentially hyperkeratosis and elongation of the papillae of the tongue with fungus growths entangled in the papillae. Hairy tongue is usually associated with septic condition of the mouth and throat. One case was reported in which the entire dorsum of the tongue was covered with a hairy growth. The superficial surface was removed with good results. Silver nitrate cauterization also has been employed with good results.—*Brit. J. Derm. & Syph.*, **44**:243, May 1937.

FRANK ALLEN.

The Relation of Malocclusion to Sigmatism

By I. J. WOLF

THE relation malocclusion bears to sigmatism is still a controversial question. Sigmatism may be divided into two forms: (1) that in which the position of the tongue is normal and dental condition is a cause, (2) that in which the position of the tongue is faulty. Potential causes of mechanical or dental sigmatism are open bite, overjet, protrusion and related abnormalities. Statistics show that a large number of lispers have malocclusion, but a definite relationship between the malocclusion and the lisping can be shown in only about 30 per cent of cases.—*Am. J. Dis. Children*, **54**:520, September 1937.

FRANK ALLEN.

Further Studies on Endemic Dental Fluorosis and Experiments on the Removal of Fluoride from Drinking Water

By H. T. DEAN and E. ELVOVE

Two articles are presented on the problem of dental fluorosis. Widely separated cities were selected in endemic communities and studies were conducted in an attempt to find a definite quantitative relationship between the fluoride concentration and the clinical manifestations of dental fluorosis. There was an orderly uniformity in the group response to the fluoride concentration of the water with regard to both the incidence and the percentage distribution of severity. Further studies focused attention on the minimal threshold of toxicity or on the maximum amount of fluoride permissible. Evidence is presented that amounts not exceeding 1 part per million are of no public health significance. One of the authors (E. E.) considered the problem of removing the fluoride from the water. Substances which appeared most favorable in this procedure were tricalcium phosphate, magnesium oxide and magnesium hydroxide. From the point of view of economic operation, further work, it was believed might prove that calcined magnesite would answer the purpose, particularly if it could be utilized later for some other purpose.—*Pub. Health Rep.* **52**:1249 and 1308, September 1937.

VIRGIL D. CHEYNE.

Acute Pyogenic Parotiditis

By JOHN HENDERSON

ACUTE parotitis follows many medical as well as surgical conditions. It is indicated that the most frequent cause of the infection is the ascension of bacteria from the mouth through Stenson's duct. The onset of the disease is usually sudden, the pathologic

process being the same as that of an acute inflammatory condition with suppuration in similar tissue. Emphasis is placed on oral hygiene through adequate dental care and maintenance of the general well being of the patient prior to operation and during the period of morbidity. Treatment consists of supportive and conservative measures with surgical intervention in the event that these prove futile. Radium is probably the most effective means of treatment.—*Am. J. Surg.* 36:125, April 1937. WILLIAM E. HAHN.

BIBLIOGRAPHICAL

"A Textbook of Clinical Periodontia: A Study of the Causes and Pathology of Periodontal Disease and a Consideration of Its Treatment."

By PAUL R. STILLMAN, D.D.S., F.A.C.D., F.A.A.P. Formerly instructor in periodontia, Columbia University, New York; formerly clinical professor of periodontia, New York University, New York City; past president of the American Academy of Periodontology; and JOHN OPPIE MCCALL, A.B., D.D.S., F.A.C.D., F.A.A.P. Formerly professor of oral hygiene and periodontia, University of Buffalo, Buffalo, N. Y.; formerly instructor in periodontia, Columbia University, New York City; formerly professor of periodontia, New York University, New York City; past president of the American Academy of Periodontology. With a chapter on normal and abnormal occlusal relations. By Egon Neustadt, M.U.D., formerly instructor in orthodontia, New York University, New York City. Second Edition, completely revised and reset. New York: The Macmillan Company. Price $3.50.

In the publication of the first edition of this book, the authors gave new impetus as well as a new name to a phase of dental practice which has since loomed large as a specialty of dentistry. While periodontal disease had long received special attention in dental practice, it had been known as pyorrhea alveolaris, and by numerous other names. Its treatment up to that time had been as varied and as uncertain as its nomenclature and it remained for Stillman and McCall to standardize and systematize both treatment and nomenclature in a manner that has established the therapeusis of periodontal diseases on a scientifically sound and eminently successful basis.

The attention thus directed to periodontal diseases resulted in a more intensified study not only of the relations of occlusion to these diseases but also of the relations of occlusion to every phase of dental practice; and the practical application of the knowledge gained by these studies has reflected itself in every phase of dentistry.

In the nature of the case, the larger portion of the book is devoted to study of the pathology, etiology and treatment of what the authors designate as periodontoclasia, but the treatment of the subject has been such as to direct special attention to the preventive aspects of dental practice. In fact, the main purpose and objective of the efforts of the authors has been to emphasize the necessity and desirability, if the aim of dentistry as a health service is to be attained, of the dentist's attention being focused on health and the means for attaining it, rather than on disease.

The technical procedures of treatment are based upon the pathologic studies of Box, and the authors present a technic for securing gingival reattachment that they claim has proved its practicability.

On the whole, the authors' treatment of the subject is a most commendable one; and while it is believed that undue emphasis on the relation of occlusal relations of the teeth to periodontal disease led to much indiscriminate and misdirected grinding of the occlusal surfaces of the teeth by the overenthusiastic, time and experience have proved the soundness of the authors' approach to the subject. The "Textbook of Clinical Periodontia"

should be included in the ready reference works of every dentist who is called on to restore the occlusal relations of the teeth.

With regard to nomenclature, the authors still leave the reader in confusion as to distinguishing between the peridental, or periodontal, membrane and the investing tissues of the teeth, as the same term appears to be used for both. May it be here suggested that "periodontium" be used to designate the so-called peridental membrane, or pericementum, and "parodontium" to designate the investing tissues of the teeth: the gingivae, pericementum and alveolar process.

"Dental Histology and Comparative Dental Anatomy"

By Rudolf Kronfeld, B.S., M.D., D. D.S., professor of dental histology and pathology in the Chicago College of Dental Surgery, School of Dentistry, Loyola University, Chicago, Ill.; worker at the Foundation for Dental Research of the Chicago College of Dental Surgery; Fellow of the American Academy of Periodontology; former assistant at the Dental Institute of the University of Vienna, Austria. Illustrated with 105 engravings and 10 plates. Philadelphia: Lea & Febiger, 1937. Price $3.75.

This clear and concise presentation of the newer knowledge of dental histology is intended primarily for the classroom. The author indicates and emphasizes the practical limited use of the volume to the classroom by stating that all the student learns of the subject is soon forgotten after he leaves the classroom and enters practice. If one should doubt the accuracy of this statement, he need only turn to the quiz section of the book and read a few of the review questions, the answers to which all of us probably should know, but which few do.

Dr. Kronfeld's style of presenting many of the disputed questions of histology is direct and quite convincing because of its conciseness and clearness. The question of the vital processes of the dentin is a case in point, and it is here that the author's didactic aptitude is eloquently displayed. Incidentally, he is quite as firm in his belief in a nutrient lymph circulation through the dentin as Bodecker, but is not so sure of the same system in the enamel. In fact, he states without equivocation that the enamel is devoid of vital processes. The author's comments on dental caries, while more or less speculative, are interesting and important by virtue of his knowledge of the histology of the tooth structures.

The views expressed on nomenclature are sound indeed, particularly on the use of the terms cuspid and bicuspid, and it is hoped that, in future editions of the present work, he will more closely follow his convictions.

The illustrations of the book are exceptional and add materially to a clear understanding of the text matter.

While most dentists feel that they have long since passed the need for knowledge of the histologic structures of the teeth, any practitioner of whatever period of practice can be assured a most interesting evening and much profit and food for thought with Kronfeld's presentation of what is ordinarily considered a dry subject.

"Accepted Dental Remedies." Containing "A list of official drugs selected to promote a rational dental materia medica, and descriptions of acceptable nonofficial articles. 1937."

Edited by Samuel M. Gordon, Ph.D., secretary of the Council on Dental Therapeutics, American Dental Association, 212 East Superior St., Chicago, Ill. Price $1.00.

A storehouse of information regarding dental remedies, drugs, new remedies, formulas, etc., that should be in the hands of every dental practitioner who wishes to keep up to date with the findings of the Council on Dental Therapeutics of the American Dental Association, "Accepted Dental Remedies" not only presents the dental remedies accepted by the Council, but also gives a full list of those which are not approved by the Council, with references to the literature wherein are stated the reasons for such disapproval.

This book issued under the direction of the Council on Dental Therapeutics is certainly a most dependable guide for all who wish to pursue the strictly ethical and entirely safe course in their use of dental remedies.

ANNOUNCEMENTS

ANNOUNCEMENTS must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

CALENDAR OF MEETINGS

American Dental Association, St. Louis, Mo., October 24-28, 1938.

National Board of Dental Examiners, December 3-4.

American Academy of Restorative Dentistry, St. Louis, Mo., October 22-23, 1938.

Academy of Anesthesiology in Oral Surgery, New York City, November 22.

American Society for the Advancement of General Anesthesia in Dentistry, New York City, fourth Monday in March and October.

Five State Postgraduate Clinic, Washington, D. C., March 6-9, 1938.

District of Columbia Dental Society, second and fourth Tuesdays in each month from October to June at the United States Public Health Service Auditorium, Washington.

Greater New York Dental Meeting, New York City, December 6-10.

Greater Philadelphia Annual Meeting, Philadelphia, February 2-4, 1938.

Great Lakes Association of Orthodontists, Cleveland, Ohio, November 1-2.

Dallas Midwinter Dental Clinic, Dallas, Texas, January 17-19, 1938.

North St. Louis District Dental Society, Annual Midwinter Meeting, January 26-27, 1938.

Rocky Mountain Midwinter Meeting, Denver, Colo., January 9-12, 1938.

American Dental Society of Europe, Stockholm, August 1-3, 1938.

STATE SOCIETIES

November

Florida, at Hollywood (4-6)
Ohio, at Columbus (8-10)
Puerto Rico, at San Juan

December

Hawaii, at Honolulu

February

Minnesota, at St. Paul (22-24)

April

Wisconsin, at Milwaukee (25-28)

May

Missouri, at Columbia (8-9)
North Carolina, at Winston-Salem (2-4)
South Dakota, at Watertown (23-24)
Tennessee, at Chattanooga (9-12)

STATE BOARDS OF DENTAL EXAMINERS

California, at San Francisco, December 6. Kenneth I. Nesbitt, 450 McAllister St., San Francisco, Secretary.

Connecticut, at Hartford, November 30-December 4. Almond J. Cutting, Southington, Recorder.

Louisiana, at New Orleans, December 16-18. Joseph L. Webre, 740 Audubon Bldg., Secretary.

Minnesota, at Minneapolis, December 10-16. Paul Hagen, Crookston, Secretary.

New Jersey, December 6-11. Walter A. Wilson, 148 W. State St., Trenton, Secretary.

Texas, at Houston, December 13-16. B. Carl Holder, 1009 Nixon Bldg., Corpus Christi, Secretary.

Wisconsin, at Milwaukee, December 13-17. S. F. Donovan, Tomah, Secretary.

MINNESOTA STATE DENTAL ASSOCIATION

The Fifty-Fifth Annual Meeting of the Minnesota State Dental Association will be held in the Municipal Auditorium, St. Paul, February 22-24, 1938.

L. M. CRUTTENDEN, *Secretary,*
481 Lowry Medical Arts Bldg.,
St. Paul.

MISSOURI STATE DENTAL ASSOCIATION

The annual meeting of the Missouri State Dental Association will be held at Columbia, May 8-9, 1938.

C. W. DIGGES, *Secretary,*
Exchange National Bank Bldg.,
Columbia.

SOUTH DAKOTA STATE DENTAL SOCIETY

The Fifty-Sixth Annual Session of the South Dakota State Dental Society will be held in Watertown, May 23-24, 1938.

ERNEST W. ELMEN, *Secretary,*
Sioux Falls.

TENNESSEE STATE DENTAL ASSOCIATION

The Tennessee State Dental Association will hold its seventy-first annual meeting at Chattanooga, May 9-12.

E. J. JUSTIS, *Secretary,*
708 Exchange Bldg.,
Memphis.

TEXAS STATE DENTAL SOCIETY

The Texas State Dental Society will hold its next meeting at San Antonio, April 25-28, 1938.

WILLARD OGLE, *Secretary,*
Dallas.

LOUISIANA STATE BOARD OF DENTISTRY

The next examination of the Louisiana State Board of Dentistry for license to practice dentistry and dental hygiene will be held in New Orleans, December 16-18. All credentials must be in the office of the secretary at least twenty days prior to the examination. Address all communications to

JOSEPH L. WEBRE, *Secretary,*
740 Audubon Bldg.,
New Orleans.

AMERICAN ACADEMY OF RESTORATIVE DENTISTRY

The American Academy of Restorative Dentistry will meet at St. Louis, Mo., October 22-23, 1938.

A. F. SCHOPPER, *Secretary,*
Professional Bldg.,
Kansas City, Mo.

NATIONAL BOARD OF DENTAL EXAMINERS

The National Board of Dental Examiners will hold a session for the examination of candidates in Parts I and II December 3-4 in such cities as five or more candidates request. For information and application blanks, address

MORTON J. LOEB, *Secretary,*
66 Trumbull St.,
New Haven, Conn.

DENTAL PROTECTIVE ASSOCIATION OF THE UNITED STATES

The annual meeting of the Dental Protective Association of the United States will be held at the Palmer House, State and Monroe Sts., Chicago, December 20th, at 4 p.m. sharp. The report of the officers will be given; a Board of Directors will be elected and such other business transacted as should come before the Association.

All members are urgently requested to be present.

By Order of the Board of Directors.

D. M. GALLIE, *President and Treasurer*
P. G. PUTERBAUGH, *Vice President*
E. W. ELLIOT, *Secretary*
55 E. Washington St.,
Chicago, Ill.

ACADEMY OF ANESTHESIOLOGY IN ORAL SURGERY

The New York Chapter of the Academy of Anesthesiology in Oral Surgery, Inc., will meet at the George Washington Hotel, New York City, November 22. Those desiring to attend, please communicate with

J. M. ESKOW, *Secretary,*
147 Market St.,
Perth Amboy, N. J.

ROCKY MOUNTAIN MIDWINTER MEETING

The Midwinter Meeting of the Denver Dental Association will be held in the new convention auditorium of the Shirley-Savoy Hotel, Denver, January 9-12, 1938.

C. E. WESTERBERG, *Secretary,*
846 Metropolitan Bldg.,
Denver.

DALLAS MIDWINTER DENTAL CLINIC

The Eleventh Annual Midwinter Dental Clinic of the Dallas County Dental Society will be held at the Hotel Adolphus, Dallas, January 17-19, 1938.

P. J. MURPHEY, *Publicity Chairman,*
Fairmount and Welborn Sts.,
Dallas.

FIVE STATE POST GRADUATE CLINIC

The Five State Post Graduate Clinic will be held in Washington, D. C., at the Mayflower Hotel, March 6-9, 1938.

JOSEPH F. MANLEY, *Publicity Chairman,*
1726 Eye St., N.W.
Washington, D. C.

THE ALUMNI ASSOCIATION OF THE COLLEGE OF PHYSICIANS AND SURGEONS OF SAN FRANCISCO

The Alumni Association of the College of Physicians and Surgeons of San Francisco will hold its annual meeting and homecoming at the college November 18-19.

ELMER P. NORWALL, *Chairman of Publicity.*

EXAMINATION FOR APPOINTMENT IN THE DENTAL CORPS, REGULAR ARMY

The War Department is announcing an examination of applicants for appointment as first lieutenants, Dental Corps, Regular Army, to be held February 7-12, 1938, inclusive. Examining boards will be convened at Washington, D. C., Denver, Colo., San Francisco, Calif., and San Antonio, Texas. To be eligible to take this examination, the applicant must be a citizen of the United States; a graduate of a recognized dental school; in good standing in his profession; between the ages of twenty-two years six months, and thirty-one years nine months, at the time of examination, and must have been engaged in the practice of his profession for at least one year and eleven months subsequent to graduation. Full information and application blanks will be furnished by the War Department on request addressed to the Adjutant General, U. S. Army, Washington, D. C. Applications will not be considered after January 22, 1938.

CLASS OF 1924 NEW YORK UNIVERSITY

The Class of 1924 of the New York University College of Dentistry will hold its thirteenth annual dinner Friday, December 10, at the Hotel Pennsylvania, New York City. For details, address

HAROLD MARKS,
2021 Grand Concourse,
New York City.

ALPHA OMEGA FRATERNITY

The Thirtieth Annual International Convention of the Alpha Omega Fraternity will be held in the Congress Hotel, Chicago, Ill., December 29-31.

S. ALBERT SIGEL, *Marshall,*
25 E. Washington St.,
Chicago, Ill.

UNITED STATES PATENTS APPLICABLE OR PERTAINING TO DENTISTRY, ISSUED DURING SEPTEMBER 1937

September 7

No. 2,092,097, to EDWARD W. TOWN. Lower Denture Retaining Device.

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No. 2,092,689, to JOHN LUTHER AUSTIN. Gauge for Dental Instruments.

September 14

No. 2,092,987, to KATE M. REMINGTON. Tooth Cleanser.

No. 2,093,006, to EDWARD L. CHOTT. Dental Polishing Cup.

No. 2,093,007, to EDWARD L. CHOTT. Mechanical Tooth Brush.

No. 2,093,383, to MORRIS RUDOF and LESTER V. LYON. Tooth Brush.

September 21

No. 2,093,457, to HARRY SEYMOUR KUKLIN. Dental Mirror.

No. 2,093, 682, to DUDLEY D. LEVY. Dental Tool Holder.

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No. 2,094,240, to GEORGE LESLIE HERRICK. Toothbrush.

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